AN ANALYSIS OF THE MANAGEMENT INFORMATION SYSTEM FOR U. S. COAST GUARD AIRCRAFT POLLUTION PATROLS

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THESIS

AN ANALYSIS OF
THE MANAGEMENT INFORMATION SYSTEM FOR
U. S. COAST GUARD
AIRCRAFT POLLUTION PATROLS

by

Jerald Howard Heinz

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An Analysis of

the Management Information System for

U. S. Coast Guard Aircraft Pollution Patrols

by

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Submitted in partial fulfillment of the
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I. INTRODUCTION

It was the purpose of this thesis to examine the present data collected and evaluate its usage in respect to one element of the U. S. Coast Guard Marine Environmental Protection Program. The element of the program examined was detection of pollution by Coast Guard aircraft. The Twelfth Coast Guard District and Coast Guard Air Station San Francisco were used for the data analysis section of this thesis.

It was found that in general more detailed and specific information was needed from the aircraft pollution detection patrols. The information that was needed was

1. where the aircraft patrolled,
2. how many aircraft employment hours were utilized in specific areas (search effectiveness), and
3. what the cost of those employment hours were (resource hours).

These three items then can be utilized when evaluating the results of the aircraft patrols if linked with the present Coast Guard Pollution Incident Reporting System (PIRS). Evaluation of patrols at the individual air station level instead of whole coast or nationwide aggregation would allow management and policy decisions to be more specifically oriented. Concise policy designed for a specific area would then contribute to a more efficient and effective program.

A proposed aircraft flight record with a supplement form for the Marine Environmental Protection mission was introduced (Chapter V). These new forms are designed to capture more detailed data with little extra effort required of the Coast Guard pilots. The forms are compatible with the present manual system. However, they are formulated to allow easy transfer of the data to computer cards if or when this system becomes automated.

In Chapter II the background and legal basis for the Coast Guard Environmental Protection Program is described along with the organization for the Coast Guard Aircraft Pollution Patrols.

The Coast Guard's present reporting system for aircraft pollution detection patrols is examined in Chapter III. This chapter describes specific data collected on the reports and what information can be obtained from them.

Data from existing reports from Air Station San Francisco for one quarter are analyzed in Chapter IV. Pollution Incident Reporting System data for two years, 1973 and 1974, are also analyzed for characteristics of reported incidents.

II. BACKGROUND

A. GENERAL

The United States Coast Guard has primary responsibility for marine environmental protection for the federal government. Coast Guard responsibility has expanded greatly in this mission in recent years with the passage of new federal laws for controlling water pollution. These laws have resulted from the marked increase of the general public's awareness and concern about pollution of the environment and their demands for preservation and improvement of the nation's environment.

With this expanded responsibility, the Coast Guard has increased the resources to be allocated to this mission. This increase of resources has resulted in demands for new data collection at the operating unit level of the Coast Guard. This data is being collected in order to provide information to the Coast Guard managers and "decision makers" as to how effectively and efficiently these resources are being utilized. Then, with the information, budget allocations, new policies and program decisions can be made that will be cost effective.

B. MISSION OBJECTIVE AND DESCRIPTION

The Coast Guard has defined the objective of its Marine Environmental Protection Program as follows:

"To minimize damage to the marine environment, and to its living resources, caused by the intentional or unintentional acts of man; to increase man's awareness and consideration of the environmental impact of his actions; and to improve the quality of the marine environment."[1]

The objective is further broken down into four elements:

1. Impact assessment
2. Prevention and enforcement
3. Response
4. In-house abatement.[2]

Impact assessment is concerned with definition of the effect and how to determine this effect of all pollutants of United States' navigable waters, tributaries, adjacent shorelines and the high seas. The Coast Guard prepares and reviews Environmental Impact Statements as part of the element. Also, the Coast Guard has a research and development effort for evaluation and selection of various sensors and monitoring equipment for marine pollution.

The purpose of the Prevention and Enforcement Element is to prevent the intentional and unintentional discharges of oil and other hazardous pollutants into United States waters. The mainstay of this element is Coast Guard surveillance. Increases in surveillance tends to decrease intentional discharges because of the fear of potential polluters in being caught and fined. Also, unintentional spills are

reduced because in general the persons become more aware and concerned about possible spillage and are therefore more careful.

The Response Element's purpose is to provide an efficient, coordinated, and effective effort to minimize any damage to the environment as a result of the discharge of oil or any other hazardous pollutant into United States waters. The National Oil and Hazardous Substances Pollution Contingency Plan designated the Coast Guard as the responsible agency for ensuring that proper clean-up action is initiated for all detected discharges. Under this plan, the Coast Guard maintains the National Strike Force, made up of three teams, Atlantic Strike Team, Gulf Strike Team, and Pacific Strike Team.

These teams respond to pollution discharges or threats of potential discharges and provide technical expertise, supervisory assistance, and deployment of special equipment designed for pollution removal operations. Also, in this element is a large Coast Guard research and development effort for pollution containment and removal equipment and hardware.

The last element, In-house Abatement, is concerned with efforts to reduce or eliminate pollution from Coast Guard facilities. Under this element, the Coast Guard is installing sewage treatment equipment on all of its ships.

C. LEGAL BACKGROUND FOR PROGRAM

The Refuse Act of 1899 prohibits the throwing, discharge or deposit of any refuse matter of any kind into U. S. navigable waters. The "navigable waters of the U.S." generally means the territory from baseline of the coast of the United States to three miles to seaward. This Refuse Act is still in use and enforced by the Coast Guard.

In 1961 the Oil Pollution Act was passed which prohibits the discharge of oil from vessels in the prohibited zone. In general, the prohibited zone is the territory from baseline of the United States coast to 50 miles to seaward. This law covers tankers over 150 gross tons and other vessels over 500 gross tons. A discharge exempted by this act is the pumping of bilges where oil has drained or leaked from the engine and machinery spaces. This exemption makes the law most difficult to enforce except in the larger discharges.

A major piece of legislation is the Federal Water Pollution Control Act of 1970. It provided for the President to promulgate regulations designating hazardous substances and recommended methods for their removal. Executive Order 11548 was issued to implement this Act. It delegated responsibility and authority to the Council on Environmental Quality for preparing, publishing, revising and amending the National Contingency Plan for the removal of oil. The Coast Guard was assigned the general responsibility for preventing oil pollution in the marine environment. The law requires the spiller to give an immediate notice

of his spill to the appropriate agency of the federal government, which is designated by an Executive Order to be the U. S. Coast Guard. Other functions delegated to the Coast Guard from this act are: issuance and regulation of procedures and requirements for equipment, as needed, to prevent discharge of oil from vessels and transportation related to on-shore and off-shore facilities; administration of the pollution fund established to pay for government clean-up of oil or other hazardous substances; issuance and enforcement of regulations for inspections of vessels carrying oil as cargo so as to prevent discharges; enforcement of this act by inspecting and boarding vessels in U. S. navigable waters and the contiguous zone; arresting violators and executing warrants. The contiguous zone is the territory from the United States coast line to 12 miles seaward.

The Federal Water Pollution Act as amended in 1972 and was called the Federal Water Pollution Control Act of 1972. This Act expanded the Coast Guard's geographical responsibilities for pollution control and expanded the 1970 Act to include other hazardous materials in addition to oil. The Act states that the policy of the United States is there shall be no discharges of oil or any hazardous substances in the navigable waters, adjoining shorelines, and the contiguous zone. The administrator of the Environmental Protection Agency (EPA) was charged by the Act to establish and maintain a water quality surveillance program. The purpose of the program is to maintain the quality

of ground waters, navigable waters, contiguous zone, and the high seas. The National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA) and the United States Coast Guard (USCG) are to be utilized by the EPA for this surveillance where practical.

The Federal Water Pollution Control Act (FWPCA) provides for fines and penalties for various violations of the Act. If a hazardous substance is spilled in the designated waters of the Act and is designated as non-removable, the violator is subject to either a penalty between $500 and $5,000 based on the substance discharged or a penalty based on the number of units discharged. This penalty shall not exceed $500,000 for a facility or $5,000,000 for a vessel.

Failure to report a spill can result in a fine of $10,000 and one year's imprisonment. A spiller is also subject to a civil penalty of up to $5,000 for each offense. Failure to comply with regulations concerning inspection, equipment and procedures for prevention of discharges can result in civil penalty up to $5,000 for each offense. The Coast Guard holds hearings for these civil penalties.

The owner and operator of a vessel, on-shore or off-shore facility are liable for clean-up and removal costs to the federal government for discharges unless the discharge occurred because of one of the following: Act of God; Act of War; negligence of the United States Government; an act of omission of a third party. A vessel owner is liable up to $100

per gross ton of the vessel or $14,000,000, whichever is smaller. The facility owner is liable up to $8,000,000. If the government can prove willful negligence or misconduct with knowledge of the owner, the owner is liable for the full amount of clean-up and removal costs.

D. FEDERAL MARINE ENVIRONMENTAL ORGANIZATIONS

The three organizations which are dominant in Federal Marine Environmental Organizations are the Council of Environmental Quality, the Environmental Protection Agency and the United States Coast Guard. The National Oil and Hazardous Substances Contingency Plan lists their specific responsibilities and they are as follows:

1. Council of Environmental Quality:

This organization sets up the National Oil and Hazardous Substances Contingency Plan and defines responsibilities and terms within the scope of the Plan. Specific definitions of interest are:

a. Minor discharge: less than 1000 gallons on inland waters or less than ten thousand (10,000) gallons in the coastal waters (waters subject to tidal variations).

b. Medium (moderate) discharge: one thousand to ten thousand (1,000 to 10,000) gallons in inland waters and ten to one hundred thousand (10,000 to 100,000) gallons in coastal waters or discharges of harmful quantities as defined in the regulations.

c. Major discharge: more than ten thousand (10,000) gallons inland and one hundred thousand (100,000) gallons in coastal waters OR

a discharge which poses a "substantial threat to the public health or welfare."

d. Removal: clean-up or removal of oil or hazardous substances from water or shoreline or other actions taken to minimize damage.

Responsibilities for enforcement are divided between the agencies involved. The EPA has responsibility for providing the On-Scene-Commander for spills occurring in inland waters, and the Coast Guard is responsible for the coastal waters, Great Lakes, ports and harbors.

The rest of the plan concerns directions and procedures for mobilization of regional and national actions to clean up spills of hazardous substances.

2. Environmental Protection Agency

The EPA has the broadest responsibilities with respect to pollution control. In regard to oil pollution the agency:

a. Establishes the requirements and guidelines for preparation of state, local and regional Oil Removal Contingency Plans, and the coordination of those plans with the National Plan.

b. Prohibits the discharge of harmful quantities of oil into the navigable waters of the U. S. that:

1. violate water quality standards

2. present a film, sheen, discoloration or sludge-emulsion.

c. Discharges into the contiguous zone are considered harmful under the same rules except where altered by International treaty or convention.

d. Prohibits the use of dispersants or emulsifiers to circumvent the provisions of the FWPCA.

e. Requires the discharger to notify the U. S. Coast Guard.

f. Requires owners and operators of onshore and offshore facilities to prepare a Spill Prevention Control and Countermeasure Plan (SPCC) that:

1. is effective in satisfying the requirements within the regulations.

2. is certified by a Registered Professional Engineer.

3. meets the approval of the regional administrator of the EPA.

g. Calls for a civil penalty of five thousand dollars ($5,000) per day for failure to provide a SPCC by a certain date. This date is a function of when the firm begins operations.

h. Sets guidelines for Spill Prevention and Countermeasures Contingency Plans.

3. U. S. Coast Guard

The role of the Coast Guard is restricted to regulation of oil pollution incidents that occur on the navigable waters and adjacent shorelines of the United States. Coast Guard regulations:

a. Establish prohibited zones for discharges within fifty (50) miles of the coast and other designated areas.

b. Require the keeping of an Oil Record Book.

c. Delegate authority to the District Commander to assess civil penalties under the Federal Water Pollution Control Act.

d. Require the notification of the Coast Guard by rapid communications.

e. Establish equipment and operating standards and inspection requirements for facilities which may discharge hazardous substances into the water.

f. Authorize the Captain of the Port to suspend operations of dangerous or potentially dangerous firms.

g. Establish personnel qualifications, requirements for operating manuals, and vessel design standards relating to oil and hazardous substance storage and transfer.

h. Administer the Pollution Cleanup Revolving Fund.[3]

E. COAST GUARD ORGANIZATION

The Coast Guard is organized with its headquarters in Washington, D.C. under the direction of the Commandant. There are two Area Commanders, Atlantic and Pacific, who are in charge of the districts in their respective areas and deal only with specified operational, inspection and training matters. The twelve districts throughout the

Coast Guard generally report directly to the Commandant, but if two or more districts within the same area are involved in a matter then they report first to the Area Commander and then to the Commandant.[4] The Air Stations are under the control of the district in which they are located. The district boundaries and air station locations are shown in Figure 1.

The Coast Guard organizations that are primarily involved in the pollution detection area are as follows: at the Headquarter's level it is the Marine Environmental Protection Division (G-WEP), which is in the office of Marine Environment and Systems (G-W); at the district level, the Marine Environmental Protection Branch (MEP), which is in the Marine Safety Division (m), is the responsible organization. Figure 2 is enclosed to show the organizations' relationships to the air stations. Also enclosed as Appendix A are the specific functions for each of these above organizations, as listed in the Coast Guard Organization Manual (CG-229).

Coast Guard Air Stations allot their flight hours to the various Coast Guard Programs they are able to serve in each of their locations. The major programs are as follows:

1. Search and Rescue Program (SAR)
2. Domestic Icebreaking Program (DI)
3. Marine Environmental Protection Program (MEP)
4. Enforcement of Laws and Treaties Program (ELT)

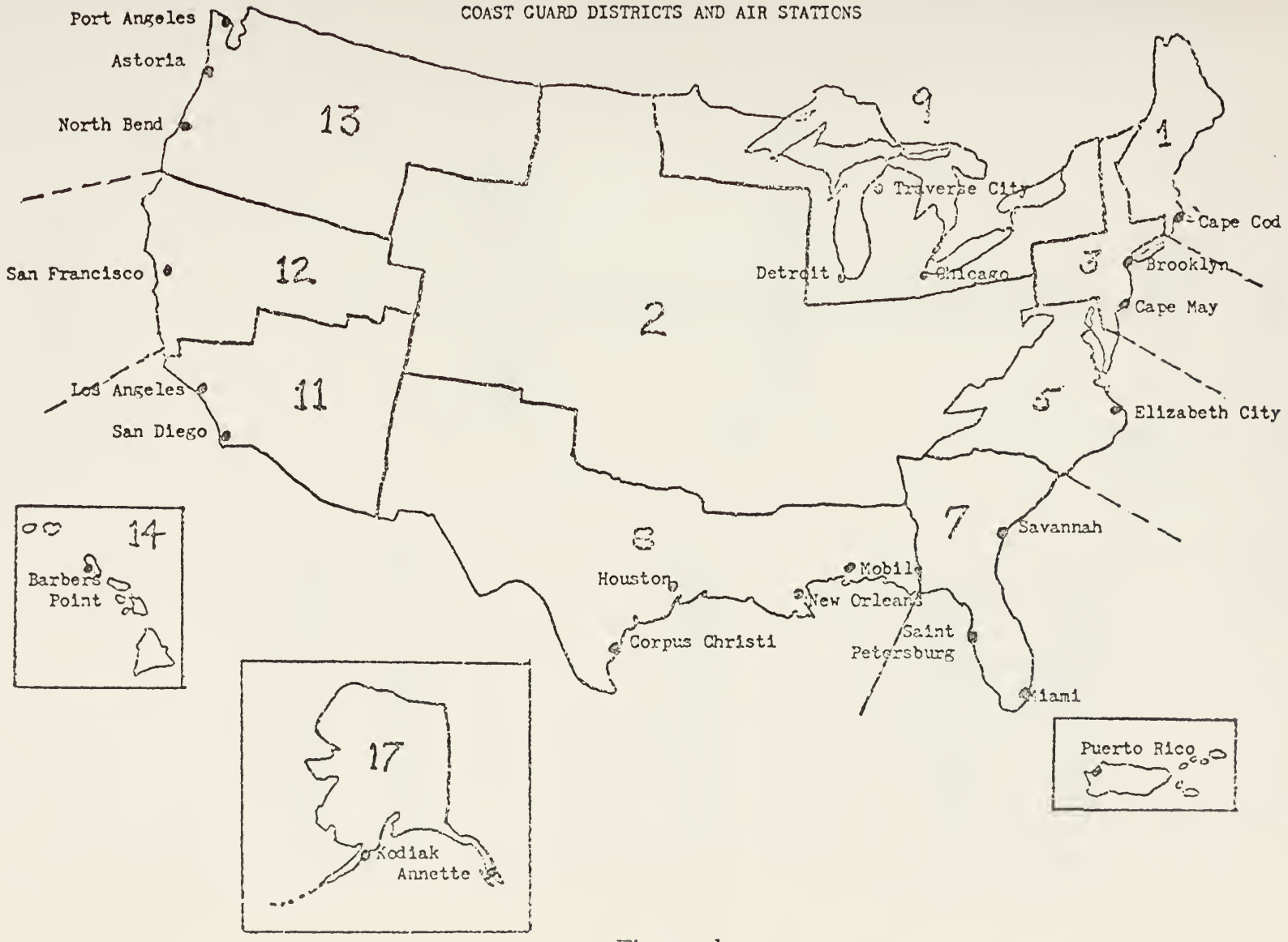
COAST GUARD DISTRICTS AND AIR STATIONS
Port Angeles
Astoria
North Bend
13
9
1
Traverse City
Cape Cod
San Francisco
12
Detroit
Chicago
3
Brooklyn
2
Cape May
Los Angeles
11
5
Elizabeth City
San Diego
14
Barbers Point
8
7
Savannah
Houston
Mobile
New Orleans
Corpus Christi
Saint Petersburg
Miami
Puerto Rico
17
Kodiak
Annette

Figure 1

COAST GUARD ORGANIZATION
FOR
AIRCRAFT POLLUTION PATROLS

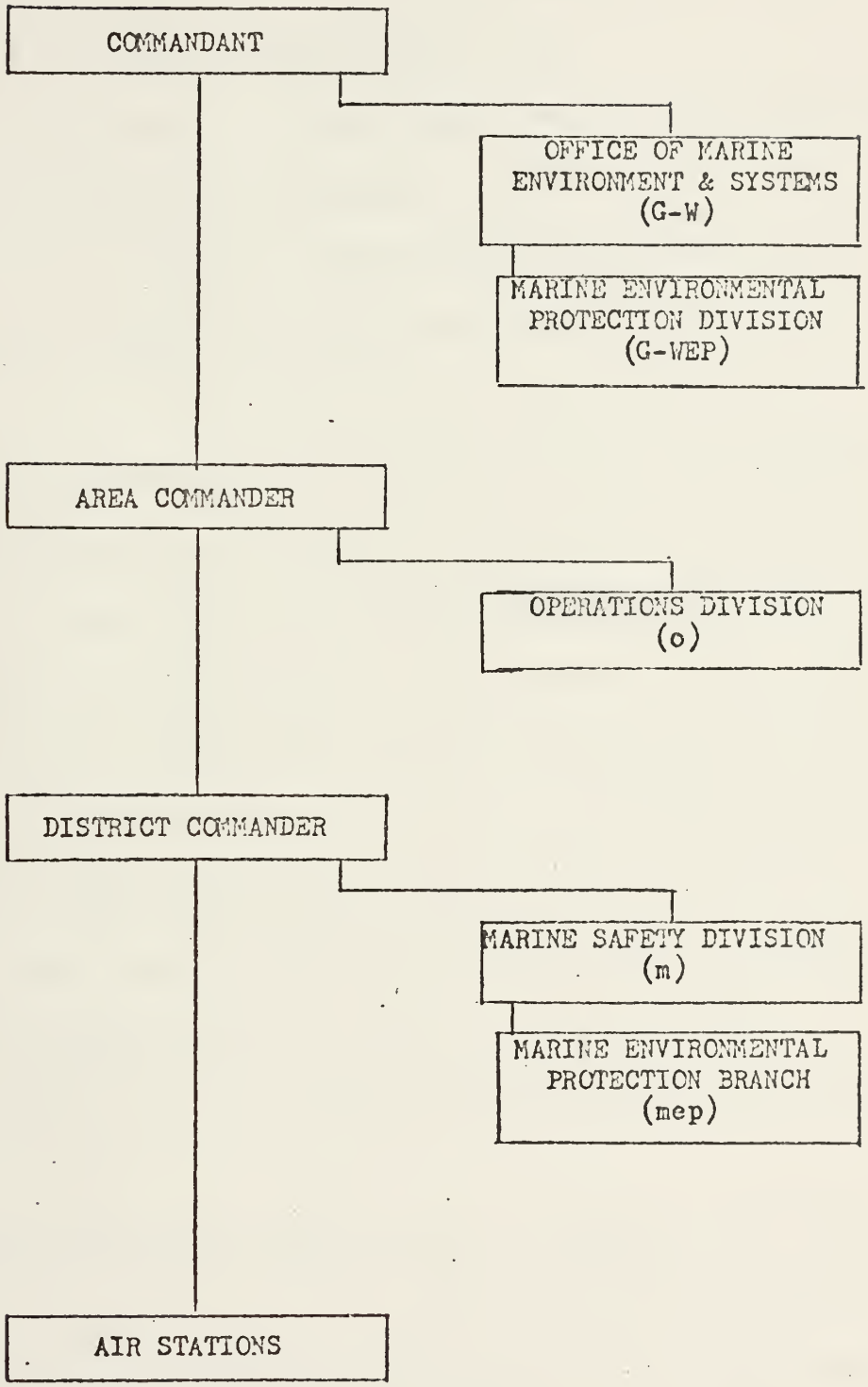

Figure 2

5. Radionavigation Aids Program (RA)

6. Short Range Aids to Navigation Program (AN)

7. Marine Science Activities Program (MSA) and

8. Port Safety and Security Program (PSS)

There are other programs including support programs that Air Station flight hours are used for, but the majority of time is spent on the above programs.[5] Other categories where flight time is allotted but not specifically to a program are operational training, ferry flights, and test flights.

Search and Rescue has been the traditional and primary mission of Coast Guard Aviation. Its objective is to render aid to persons and property in distress on, over and under the high seas and waters under the jurisdiction of the United States. Though primary responsibility is for the maritime region, Coast Guard aircraft are used over adjacent coastal land areas for search and rescue when needed and available. The present trend in Coast Guard Aviation has been an increase in demand for flight time in other programs besides SAR. The Search and Rescue Program still holds a high priority in the demand for the limited aircraft resources, but other programs are starting to make inroads.

The Marine Environmental Protection Program is one of these programs. The major demand for flight hours is for surveillance patrols with some time allocated for response efforts. The Commandant

of the Coast Guard published mission performances standards for the Port Safety and Security Program and the Marine Environmental Protection Programs in Commandant Instruction 2130. 11 of 8 January 1973.

The flight surveillance standard for U. S. off-shore waters is to conduct twice weekly flights over territorial waters and the contiguous zone. Also, random flights of the prohibited zone shall be flown.

The standard for port areas handling over 10,000,000 tons of petroleum products per year is to conduct daily surveillance flights of the main harbor and at least 10 miles seaward over the approach channels. The port areas handling over 10,000,000 tons of petroleum products annually presently are:

1. Portland, Maine
2. Boston
3. New York Harbor/New Haven
4. Delaware Bay
5. Chesapeake Bay
6. Mississippi River Delta
7. Lake Charles
8. Port Arthur
9. Galveston Bay
10. Corpus Christi
11. Los Angeles-Long Beach
12. San Francisco Bay
13. Puget Sound[6].

The response effort utilizes Coast Guard aircraft primarily for transportation of oil pollution containment and removal equipment such as: the high sea oil containment boom; oil skimmers for removal; and the Air-Deliverable and Anti-Pollution Transfer System (ADAPTS), which was developed by the Coast Guard. Coast Guard aircraft are also used as aerial platforms for monitoring and directing clean-up efforts of a pollution discharge.

The Coast Guard presently has four types of aircraft to perform its operational missions:

1. Long Range Search (LRS) - HC-130
2. Medium Range Search (MRS) - HU-16E
3. Medium Range Recovery (MRR) - HH-3F
4. Short Range Recovery (SRR) - HH-52A

The HC-130 is made by Lockheed and is called the "Hercules." It is an all-weather, high performance, four engine, turbo prop, long range aircraft. It is a highly versatile aircraft capable of carrying 35,000 pounds of cargo, or as a search vehicle it can proceed 1200 nautical miles at 25,000 to 30,000 feet altitude at 300 knots, let down and search for 2.5 hours, and return to base.

The HU-16E is made by Grumman and is called the "Albatross." It is an all weather amphibious, twin reciprocating engine, medium range aircraft. Its capabilities as a search aircraft are that it can proceed 500 nautical miles, search for 2.5 hours, and return to base.

The HU-16E is the oldest of the aircraft the Coast Guard has in its inventory. A new aircraft for replacement is in the process of being procured by the Coast Guard at this time.

The HH-3F is built by Sikorsky and is called the "Pelican." It is an amphibious, twin turbine, medium range helicopter. For a rescue, it can proceed 300 nautical miles off-shore hours for 20 minutes or land on the water and return to base. As a search vehicle, it can proceed 200 nautical miles, search for 2.5 hours, and return to base.

The HH-52A is built by Sikorsky and is called the "Sea-Guard." It is an amphibious, single turbine, short range helicopter. This helicopter can proceed 150 nautical miles off-shore at 90 knots, hover for 20 minutes, or land on the water, and return to base. However, an escort is required if proceeding more than 25 nautical miles off-shore because of the single engine configuration and limited navigational capability.[7]

F. COAST GUARD AIR STATION SAN FRANCISCO

Coast Guard Air Station San Francisco is in the Twelfth Coast Guard District and located at San Francisco International Airport. This is the only air station in the Twelfth District. Present assignment of aircraft are four HH-52A helicopters, three HU-16E and three HC-130 fixed-wing aircraft. Assignment of personnel at the Air Station are approximately 54 officers and 220 enlisted men. Percentages of number of missions and flight hours flown on various programs for a recent year are shown in Table I.

TABLE I

MISSION AND FLIGHT HOUR BREAKDOWN FOR
AIR STATION SAN FRANCISCO
YEAR ENDING 31 MARCH 1975

H-52A - 4

MISSION PROGRAM	NUMBER OF MISSIONS	%	FLIGHT HOURS	%
SAR	567	37.1	800	39.6
MEP	264	17.3	369	18.2
ELT	15	1.0	19	.9
TRAINING	405	26.5	650	32.1
ALL OTHERS	279	18.2	184	9.1

TOTAL MISSIONS - 1530

TOTAL FLIGHT TIME - 2022

HU-16E - 3

SAR	95	18.0	366	23.1
MEP	93	17.6	309	19.5
ELT	26	4.9	133	8.4
TRAINING	195	36.9	424	26.7
ALL OTHERS	119	22.5	353	22.3

TOTAL MISSIONS - 528

TOTAL FLIGHT TIME - 1585

HC-130 - 3

SAR	233	46.7	1299	61.6
MEP	23	4.6	70	3.3
ELT	41	8.2	184	8.7
TRAINING	159	31.9	372	17.6
ALL OTHERS	43	8.6	183	8.7

TOTAL MISSIONS - 499

TOTAL FLIGHT TIME - 2108

Air Station San Francisco mission surveillance requirements for the Marine Environmental Protection Program are covered in Annex G of the Twelfth Coast Guard District Operations Plan. The harbor patrols of San Francisco Harbor are required five times a week and the off-shore patrols are required twice a week.

The harbor patrols of San Francisco Harbor are flown with HH-52A helicopters. The off-shore patrols are divided between the two fixed-wing aircraft models, the HU-16E and the C-130. Response efforts for equipment transport rely mainly on the HC-130's, however both HH-52A and HU-16E could be used for the lighter cargoes or harbor discharges.

III. CURRENT POLLUTION REPORTING SYSTEM

Presently, there are four main sources that can be used by the program manager or decision maker in managing the Aircraft Pollution Detection Program. They are the Aircraft Flight Records, the Abstract of Operation Aircraft Report, the Port Safety/Marine Environmental Protection Activities Report, and the Pollution Incident Reporting System.

The Aircraft Flight Records are the original source documents that are filled out by pilots in recording the details of their flights. The Abstract of Operation Aircraft Report is in general a summary of mission and flight time by program categories. The Port Safety/Marine Environmental Protection Activities Report is generally concerned with the number of surveillance flights flown, number of detections and total hours flown on the patrols. The last source, the Pollution Incident Reporting System, is a data base with information describing in detail the spill itself, the clean-up efforts, and any penalty action associated with the spill.

A. AIRCRAFT FLIGHT RECORD

Before going into greater detail of the above reports, the source document for the Coast Guard aircraft flight hours will be described. This document is part II of the Aircraft Flight Record Coast Guard

Form CG-477 (figure 3). In the Coast Guard Aviation community this document is commonly referred to as the "blue sheet." This sheet is filled out by the aircraft commander for every flight by a Coast Guard aircraft and provides a record of who was on the flight, the total flight time, what mission categories were flown, various detections and arrival time. In general, it is a somewhat detailed breakdown of what was done on the flight.

To better evaluate the multimission flights performed by Coast Guard aviation, the concept of resource hours and employment hours was introduced. The total resource hours on one particular flight are the actual total hours flown. The costs for various programs are "billed" on the resource hours. Employment hours are the hours actually spent on a particular mission on the flight even if two or more missions were being performed at the same time. Therefore, the employment hours for one flight will generally be greater than the resource hours. This concept can be confusing and an example follows for further clarification: A Coast Guard aircraft that flew for a total of four (4.0) hours was assigned two missions to perform, Marine Environmental Protection surveillance (MEP) and Enforcement of Laws and Treaties (ELT). On the flight, these missions were being performed simultaneously for the whole flight. Therefore, the employment hours for the MEP mission would be 4.0 hours and the ELT mission would be 4.0 hours, a total of 8.0 hours. The resource hours should be divided

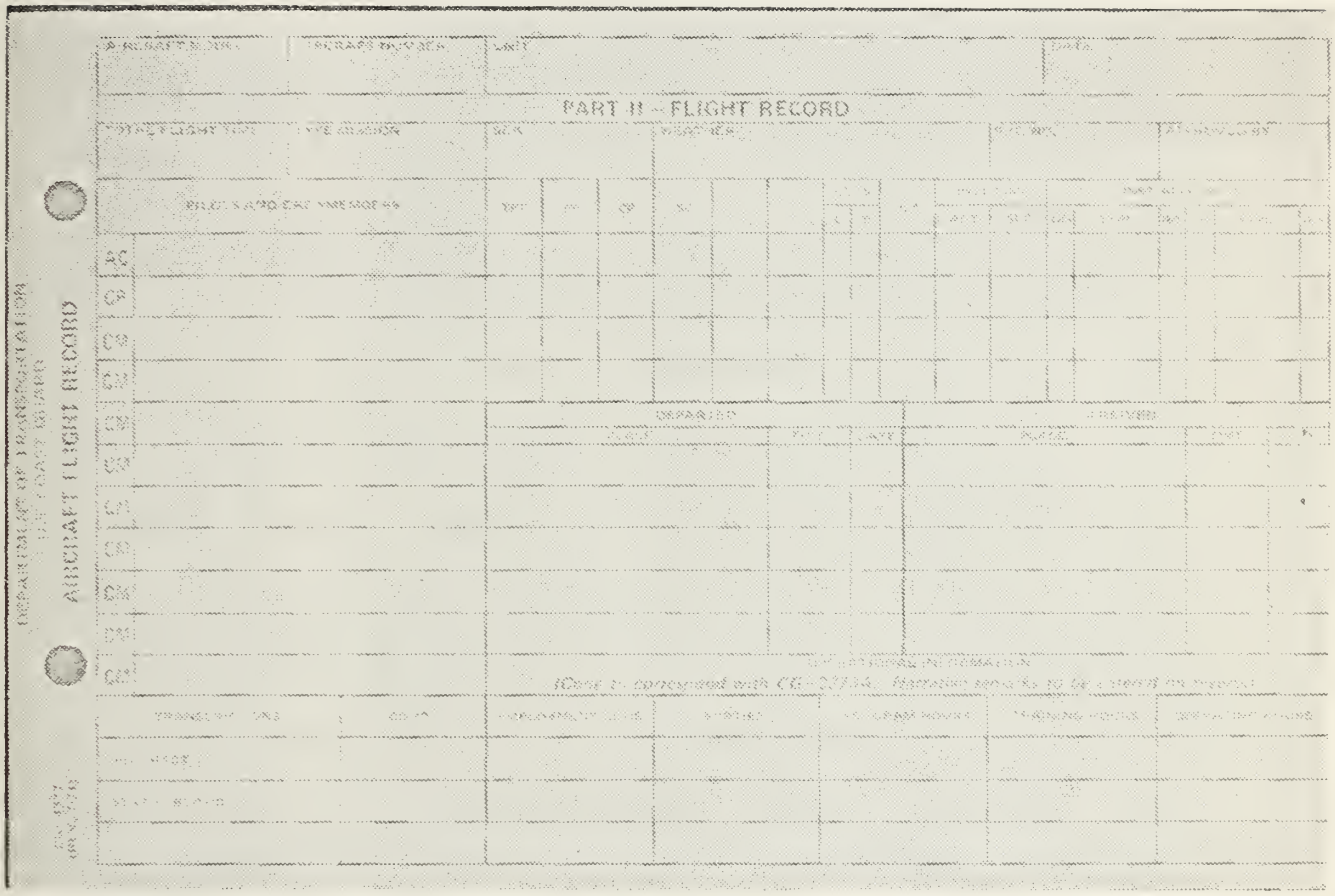

Figure 3

evenly between the two missions and would be 2.0 hours for MEP and 2.0 hours for ELT, a total of 4.0 hours. Now, consider a similar flight of 4.0 hours, for which the MEP mission was flown first for 1.5 hours and then the ELT mission was flown for 2.5 hours. The employment hours (actual time spent on each mission) would be MEP, 1.5 hours and ELT, 2.5 hours, a total of 4.0 hours. The resource hours would be 1.5 hours MEP and 2.5 hours ELT, also a total of 4.0 hours. Here the resource hours equal the employment hours. This is always true when only one mission is being performed at a time.

The aircraft commander is responsible for using his best judgement to assign the flight hours to various missions performed during his flight. Though a simple concept, it becomes complicated and requires some accurate bookkeeping by the pilot during the flight if simultaneously conducting two or more missions. Consideration has to be given to what missions are being performed when another mission begins or ends. After filling out the front of the "blue sheet," the aircraft commander writes a brief description of the flight on the back and signs his name.

The "blue sheets" are kept at the air station level and information is taken manually from them for completion of the required reports. With this present manual system there is no way to examine the "type" of flight that is detecting pollution incidents. The information that could be of help in managing the detection element of the MEP program is the

other missions being flown with pollution patrols, type of aircraft, whether the aircraft is sensor-equipped, how the pollution was detected, and the number of pollution incidents detected on the patrol.

B. ABSTRACT OF OPERATIONS AIRCRAFT REPORT

The Abstract of Operations Aircraft Reports are submitted quarterly by all Coast Guard Air Stations. A copy of the form is included as figure 4. This report is a summary by aircraft type for each air station of total missions, resource hours, and employment hours by program category for the entire quarter. The missions on this report are defined as the number of times a program category is benefited under different sets of orders either written or verbal. This concept is sometimes confused with sortees used in search and rescue. A sortee is defined as a flight from take-off to landing and securing the aircraft.

The Abstract of Operations Aircraft Report reports data to compute a ratio of resource hours to employment hours in the Marine Environmental category. From this ratio a cost per employment hour may be calculated from cost figures per resource hour for each type of aircraft. Even without the cost figure a comparison of ratio between air stations can be examined with the lowest ratio giving the least cost per employment hour.

This ratio can also give an indication for the portion of the employment hours performed on simultaneous multi-mission flights. If the ratio is equal to or very close to one then it can be ascertained that most of the MEP missions performed were one mission at a time. As

DEPARTMENT OF TRANSPORTATION U. S. COAST GUARD CG-3273A (Rev. 7-73)	ABSTRACT OF OPERATIONS AIRCRAFT REPORT	REPORTS CONTROL SYMBOL COS-2002AV

A. UNIT IDENTIFICATION

1 ACCOUNTING CODE NO.	2 REPORTING UNIT		
3 QUARTER ENDING	4 NO BOATS REPORTED	5 NO AIRCRAFT MODELS ATTACHED	6 AIRCRAFT MODEL IDENTIFICATION

B. UTILIZATION DATA

EMPLOYMENT CATEGORY	MISSIONS	NONSHIPBD RESOURCE HOURS	SHIPBOARD RESOURCE HOURS	EMPLOYMENT HOURS	EMPLOYMENT CATEGORY	MISSIONS	NONSHIPBD RESOURCE HOURS	SHIPBOARD RESOURCE HOURS	EMPLOYMENT HOURS
7. SEARCH AND RESCUE					8. MILITARY OPERATIONS				
9. PORT SAFETY AND SECURITY					10. ENFORCEMENT OF LAWS AND TREATIES				
11. MARINE ENVIRONMENTAL PROTECTION					12 SHORT RANGE AIDS TO NAVIGATION				
13. RADIO-NAVIGATION AIDS					14. OPERATIONAL TRAINING				
15. BRIDGE ADMINISTRATION					16 BOATING SAFETY				
17. DOMESTIC ICEBREAKING					18. MILITARY PREPAREDNESS				
19. POLAR OPERATIONS					20. MARINE SCIENCE ACTIVITIES				
21. CADET AND OC TRAINING					22. RESERVE TRAINING				
23. CO-OP WITH OTHER AGENCIES					24. PROFICIENCY TRAINING				
25. ADMINISTRATIVE					26. TEST				
27. FERRY									

C. DATA SUMMARY

28. TOTAL MISSIONS		29. TOTAL NONSHIPBD RESOURCE HOURS		30. TOTAL SHIPBD RESOURCE HOURS		31. TOTAL EMPLOYMENT HOURS	
32. SAR STANDBY		33. ELT STANOBY		34. TOTAL PROGRAM STANDBY		35. TOTAL OTHER STANDBY	
36. NOT OPERATIONAL READY MAINT. (NORM)		37. NOT OPERATIONAL READY SUPPLY (NORS)		38. TOTAL MAINT. HOURS (NORM + NORS)		39. AVERAGE NO. A C ASSIGNED	
40. AIRCRAFT UTILIZATION							

D. REMARKS *(Continue on reverse, if necessary)*

DATE	SIGNATURE OF COMMANDING OFFICER OR OFFICER IN CHARGE ⟶

Previous editions are obsolete

Figure 4

the ratio gets smaller, one can not conclude the exact ratio of sole mission MEP hours to simultaneous multi-mission MEP hours because there is no way to determine how many missions are being performed simultaneously with the MEP mission. However, from this writer's personal experience and research for this thesis, it is assumed that only one mission will be flown simultaneous with the MEP mission, since there are very few instances where an aircraft flight has performed more than two missions at the same time. Therefore, with this assumption, the ratio would range from 1 (no simultaneous multi-mission) to 0.5 (all multi-missions). Therefore, the ratio of 0.75 would mean that one half of the employment hours were simultaneous multi-missions hours where employment hours were shared with another mission.

Also from the Abstract of Operations Report can be obtained the average mission length, which is obtained by taking the total employment hours divided by the total number of missions. This can also be obtained for each aircraft type.

C. PORT SAFETY/MARINE ENVIRONMENTAL PROTECTION ACTIVITIES REPORT

The purpose of the Port Safety-Marine Environmental Protection Activities Report is to collect data necessary for operational analysis, facilities planning, and budget programming of Coast Guard units performing PSS/MEP duties. A copy of the report is included as figure 5.

Port Safety/Marine Environmental Protection Activities Report
Page 2

SECTION I. MISSION PERFORMANCE STATISTICS (Cont.)

ITEM DESCRIPTION	OPERATIONS TOTAL	NUMBER COMPLETED	MAN-HOURS EXPENDED	VEHICLE HOURS EXPENDED	BOAT HOURS	% OF STO
	1	2	3	4	5	6
B. RESPONSE 1.a Discharge Monitoring						
1.b Discharge Removal						
C. INVESTIGATION AND ENFORCEMENT 1.a Main Harbor Surveillance Flights						
1.b Coastal and Contiguous Zone Flights						
2.a Discharge Investigations — POL. Discovered						
2.a Discharge Investigations — POL. Not Discovered						
3.a Accident Investigations						

SECTION II. OCCURRENCE REPORT

1. No. Port Security Cards Issued

2. No. Security Advisory Warnings Issued

3. Violations Detected during Patrols

ITEM	DISCHARGES		LOAD LINE		ANCHORAGES		OTHER	
DAY								
NIGHT								
REMOTE								

4. 33 CFR VIOLATIONS

ITEM	124		126		151		153		154		155		156	
FACILITY														
T/V														
T/B														
M/V														

5. 46 CFR VIOLATIONS

ITEM	D		I		N		O	
VESSEL								

6. No. of Casulties

a. Facilities	b. Vessels

7. No. of Facility		8. No. of Vessels		9. No. of Losses *(Thousand $)*	
a. Deaths	b. Injuries	a. Deaths	b. Injuries	a. Facility	b. Vessels

10. No. of SIV.		11. Oil Transferred *(bbls)*	12. Other Hazardous Substances	13. Volume Oil Spilled *(bbls)*
a. Port calls	b. Days			

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Page 2

Figure 5

The questionnaire is divided into four general areas: Heading, Mission Performance Standards Statistics, Occurrence Report, and Additional Man-Hours. It is submitted quarterly to the Commandant via the chain-of-command, and only two rows are filled out by air stations. They are row 1, a-Main Harbor Surveillance Flights and row 1. b-Coastal and Contiguous Zone Flights. Instructions for filling out these two rows are contained in Commandant Instruction 5010. 5 of 14 September 1973. They are:

"Surveillance Flights-In column 1 enter the number of discharges detected by surveillance flights. Note that column 5 should contain the number of aircraft hours utilized. Since an overflight may involve more than one main harbor, coastal and contiguous zone flights do not involve shore unit jurisdictions and the required information will not generally be available to the reporting units, this section should be completed in the district "m" report only, using its records or the records of the applicable air station. It should include data on all surveillance flights in that district. No attempt should be made to allocate flights or aircraft hours to a particular shore unit. It should be noted that the revised Abstract of Operations will require the air stations to maintain the data needed to complete the form."[8]

From the Port Safety/Marine Environmental Protection Activities Report is obtained the percentage of the standard (described in Chapter II) by number of patrols that were performed and the number of

detections in the two categories: main harbor patrol; and coastal and contiguous zone patrol. These percentages are obtained directly from the report. The average length of each patrol by category can be obtained by dividing the aircraft hours in column 5 by the number of patrols completed in column 2. The average number of detections per patrol or patrol hours can be calculated by dividing the total number of detections in column 1 by the total number of patrols completed or the total aircraft hours.

In column 5 is the number of aircraft hours utilized" for these patrols. This entry is ambiguous as to whether it means employment hours or resource hours. While conducting research for this thesis, it was found that resource hours had been used on some reports and employment hours on others, because the Commandant Instruction 5010.5 of 14 September 1973 was written before the concept of employment hours and resource hours was established. There is no official instruction specifying which hours should be put in column 5. For the current system, one has to examine the Abstract of Operations in conjunction with the hours in column 5 and attempt to ascertain whether they are resource hours or employment hours. These aircraft hours are not broken into aircraft type and are aggregated into one figure of total hours. Therefore, by doing the "detective" work mentioned above, by examining what type of aircraft are attached to the air station, and making assumptions as to what percentage by aircraft type fly in each category of patrol, an approximate cost per detection can be obtained.

D. POLLUTION INCIDENT REPORTING SYSTEM

Another source of valuable information available to the program manager of the aircraft Pollution Surveillance Program is the Pollution Incident Reporting System (PIRS). This system was first developed by the Coast Guard in 1971 to collect data relative to the nature of oil discharges into waterways.[9] The PIRS data base was greatly expanded after the Federal Water Pollution Act of 1972. This was necessary to meet the growing demands upon the Coast Guard for information on pollution incidents in United States waters. PIRS now collects data on many aspects of the pollution incident, ranging from reporting the discharge to the issuance of penalty action on the spiller. There are three forms covering the three phases of an incident: discharge, response and penalty action. They are included as figures 6, 7 and 8, respectively.

The data is first collected on Coast Guard standard forms by local Coast Guard units that receive the information from internal reporters or from agencies, corporations, and individuals outside the Coast Guard. The forms are then sent to district for validation and data processing. It is keypunched and sent over telephone lines to Coast Guard Headquarters in Washington, D.C. At Headquarters, the data is batch-processed and stored on magnetic tape. The record key is a unique number assigned to the incident at the district level. Record length is 424 characters with approximately 68 data fields.

The Pollution Incident Reporting System contains a vast storehouse of data. Information of importance to the program manager that can be

DEPARTMENT OF TRANSPORTATION U. S. COAST GUARD CG-4890 (10-74)	POLLUTION INCIDENT REPORTING SYSTEM (PIRS) *(DISCHARGE)*	INPUT TO PIRS PRE-EDIT 12210M

NOTE: 1. A - Alpha, N - Numeric (zero-fill), A/N - Alpha/Numeric
2. Columns 1 thru 16 same for both cards.

	FIELD	CARD COLUMN	DATA
RECORD ID	District	1-2 (N)	
	Sequence Number	3-7 (N)	
	Date of Incident	8 - 13 (N)	Yr. Month Day
	Transaction Code	14 - 16 (A)	ADD/COR/DEL
DISCHARGE	Card Number	17 (N)	1
	Time of Occurrence	21 - 23 (N)	Day of Week Hour of Day
	Location	24 - 33 (A/N)	
	State	34-35 (A)	
	Water Body	36 - 38 (N)	
	Source	39 - 41 (A/N)	
	Source Identifier	42 - 49 (N)	
	Cause	51-52 (A)	
	Operation	54-55 (N)	
	Material	56 - 59 (N)	
	Quantity	60 - 67 (A/N)	
	Affected Resources	69 - 74 (A/N)	
	Report Period Date	75 - 80 (N)	Yr. Month Day
	Card Number	17 (N)	2
	Wind Speed/Direction	21 - 25 (N)	Knots ^{o} True
	Sea Hgt/Swell Direction	26 - 30 (N)	Feet ^{o} True
	Current Speed/Direction	31 - 35 (N)	Knots ^{o} True
	Notifier	40-41 (A/N)	
	Anticipated Response	42 (N)	
	OPFAC Number	44 - 53 (A/N)	
	Report Period Date	75 - 80 (N)	Yr. Month Day

Figure 6

DEPARTMENT OF TRANSPORTATION U. S. COAST GUARD CG-4890A (10-74)	POLLUTION INCIDENT REPORTING SYSTEM (PIRS) (RESPONSE)	INPUT TO PIRS REPORT 12210M

NOTE: 1. A - Alpha, N - Numeric (Zero fill), A/N - Alpha-Numeric, and N/S - Numeric-Special Character.
2. Columns 1 thru 16 same on all cards.

	FIELD	CARD COLUMN	DATA
RECORD ID	District	1-2 (N)	
	Sequence Number	3 - 7 (N)	
	Date of Incident	8 - 13 (N)	Yr. Month Day
	Transaction Code	14 - 16 (A)	ADD COR DEL
RESPONSE	Card Number	17 (N)	3
	Removal Undertaken By (Party)	21 (N)	
	Equipment: Boom Materials	22 - 24 (N)	10's of feet
	Recovery Devices	25-26 (N)	Units
	Disposable Absorbents	27 - 30 (N)	Tons
	Recycleable Absorbents	31 - 33 (N)	Lbs.
	Burning Agents	34 - 36 (N)	Lbs.
	Dispersants	37 - 39 (N)	Gal.
	Herders	40 - 42 (N)	Gal.
	Sinking Agents	43-45 (N)	Lbs.
	Personnel (In man-days): CG Regular	55 - 57 (N)	
	CG Reserve	58 - 60 (N)	
	National Strike Force	61 - 63 (N)	
	EPA	64 - 66 (N)	
	Dept. of Defense	67 - 69 (N)	
	Commercial	70 - 72 (N)	
	Report Period Date	75 - 80 (N)	Yr. Month Day
	Card Number	17 (N)	4
	Personnel (Cont.): Volunteer	21 - 23 (N)	
	Other	24 - 26 (N)	
	Duration of Response	33 - 35 (N)	Days
	Amount Recovered	36 - 43 (A/N)	
	Cost of Cleanup: Total Cost	44 - 51 (N/S) $	
	Expenditures from Pollution Fund	52 - 58 (N) $	
	Reimbursements to Pollution Fund	59 - 65 (N) $	
	Reimbursements Pending	66 - 72 (N) $	
	Incomplete Reimbursement-Reason	73 (N)	
	Report Period Date	75 - 80 (N)	Yr. Month Day

Figure 7

DEPARTMENT OF TRANSPORTATION U. S. COAST GUARD CG-4890B (10-74)	POLLUTION INCIDENT REPORTING SYSTEM (PIRS) *(PENALTY ACTION)*	INPUT TO PIRS PRE-EDIT 12210M

NOTE: 1. A - Alpha, N - Numeric (zero-fill)
2. Columns 1 thru 16 same on all cards
3. The following Card Numbers will be used when: No Action - Card 6, 1st action- Card 6, 2nd action - Card 7, 3rd action - Card 8, and 4th action - Card 9.

	FIELD	CARD COLUMN	DATA
RECORD ID	District	1-2 (N)	
	Sequence Number	3 - 7 (N)	
	Date of Incident	8 - 13 (N)	Yr. Month Day
	Transaction Code	14 - 16 (A)	ADD/COR/DEL
PENALTY ACTION	Card Number	17 (N)	
	No Coast Guard Action - Reason	21-22 (N)	
	Initiating Agency	26 (N)	
	Authority	27-28 (N)	
	Action Taken Against (Party)	29 (N)	
	Action Date	30 - 33 (N)	Month Day
	Referral to U. S. Attorney	34 (N)	
	Referral to COMDT/Other Agency	35 (N)	
	Action by U. S. Attorney	36 (N)	No - 0/Yes - 1
	Penalty Penalty, Fine, or Settlement Assessed	39 - 43 (N)	
	Imprisonment	44-45 (N)	
	Suspension, Revocation, Probation	46 (A)	S/R/P
	Hearing or Trial	47 (N)	
	First Appeal	48 (N)	
	Second Appeal	49 (N)	
	Civil Action Appealed to U. S. Court	51 (N)	No - 0/Yes - 1
	Penalty, Fine, or Settlement Collected	53 - 57 (N)	
	Case Closed	58 (N)	
	Report Period Date	75 - 80 (N)	Yr. Month Day

Figure 8

obtained are 1) Where are all the spills occurring?, 2) The total number of spills, 3) Classification of number of spills by volume spilled, 4) Spills detected by Coast Guard aircraft, and 5) Crosstabulation of all data fields by the Coast Guard detected incidents.

One problem with the data base is that an incident is listed in the system as being detected by a Coast Guard aircraft, but does not tell from which air station the aircraft was assigned. Thus, the manager cannot evaluate each air station individually. However, in some districts where there is only one air station and little flying of pollution patrols across district boundaries, an assumption may be made that oil spills in the district detected by Coast Guard aircraft are from the one air station in that district. In order to remove this assumption, a manual search of the air station "blue sheets" would have to be undertaken.

An important tool that can be utilized from the PIRS data is a plot of pollution incidents in an area of responsibility of interest. Conditional requirements on a certain data field or combination of data fields in the record could be attached in the plotting of an incident. Some examples are: only Coast Guard detected incidents, spiller-reported incidents, certain volume-limited incidents and vessels-caused spills.

The location of an incident displayed on a plot in conjunction with such information as notifier, source, material and amount, should be a valuable tool to the manager. It can help the manager assess how his surveillance has worked and provide possible alternatives on where

and how to allocate future surveillance resources. Over a period of time, trends should become evident and can be acted on by the manager in his allocation process or policy decisions. For example, if incidents do not increase in an area where Coast Guard surveillance of offloading operations has been reduced from a mandatory level to a random check, then this reduction in man hours has not adversely affected the program objective and could continue. This plot has much versatility that can be used by the manager in making the program more effective, and examples of these plots are enclosed as Appendix C.

IV. DATA ANALYSIS

This chapter examines actual reports from Air Station San Francisco for the quarter ending 31 March 1974, and extracts the information that is available from the reports as explained in Chapter III.

First, from the Aircraft Flight Record can be obtained information describing what type of flight and aircraft detected a pollution incident. The "blue sheets" for the quarter were recorded and keypunched on computer cards (an example of the computer program and output are enclosed as Appendix E). Table II relates flight-detected pollution incidents for the quarter described above:

TABLE II

Flight Description of Aircraft Detecting Pollution
at Air Station San Francisco for Quarter Ending 31 March 1974

	Detections	Number of Flights	Total Resource Hours	Total Employment Hours
HH-52A	10	9	15.0	16.2
HU-16E	5	5	17.5	17.5

All HU-16E employment hours on MEP were flown on single missions, while 83.8% of the HH-52A MEP employment hours were flown on single missions.

Table III shows the average length of time spent on each mission category per flight.

TABLE III

Average Mission Hours for Aircraft Flights Detecting Pollution at Air Station San Francisco for Quarter Ending 31 March 1975

	Total Flight Length	SAR	MEP	Operational Training	ELT	Other
HH-52A Resource Hours	1.67	0.04	0.76	0.48		0.39
HH-52A Employment Hours	1.80	0.08	0.82	0.51		0.39
HU-16E Resource Hours	3.50		3.50			
HU-16E Employment Hours	3.50		3.50			

In calculating the cost per detection from previous tables, it was assumed that all detections should be credited to MEP flight hours. With the individual flight records available, and assuming that the detections could have been found while conducting any mission, the number of detections credited to MEP flight mission hours can be calculated. The portion of each flight spent on MEP flight hours was calculated and the results are in Table IV.

TABLE IV

Detection per Mission for Air Station San Francisco Under Equally Likely Assumptions for Quarter Ending 31 March 1974

Mission	Number of Detections
MEP	6.12
SAR	0.57
Operational Training	1.69
ELT	0.00
Other	1.62
Total	10.00

Under the first assumption, all ten detections were credited to the HH-52A MEP hours and in the second assumption only 6.12 detections were credited to HH-52A MEP hours. These figures give the minimum to maximum range possible for the detections that can be credited to MEP hours. The true number is to be found somewhere in this range.

Next, from the Abstract of Operations Aircraft the average mission length for the Marine Environmental Protection Program and the resource hour to employment hour ratio are obtained by aircraft type and are in Table V.

Table V

Average Marine Environmental Protection Missions
for Air Station San Francisco for Quarter Ending 31 March 1974

Aircraft Type	Average Employment Hour per Mission	Resource Hour to Employment Hour Ratio	Percentage of Employment Hours Where One Mission Performed
HH-52A	1.375 hrs.	.919	84%
HU-16E	2.92 hrs.	.836	67%
HC-130B	2.30 hrs.	.913	83%

Next, information from the Port Safety/Marine Environmental Protection Activities Report for the same quarter is listed in Table VI.

From a comparison of the two reports, additional information can be extracted, assuming all Main Harbor flights are by HH-52A and all Coastal and Contiguous Zone patrols are by fixed wing aircraft, either the HU-16E or the HC-130B. This assumption is necessary because the

Table VI

Information from PSS/MEP Activities Report from
Air Station San Francisco for Quarter Ending 31 March 1974

	Detections	Number of Flights	Flight Hours	% of Standard
Main Harbor Flight	15	67	89	74.4%
Coastal and Contiguous Zone Flights	3	20	59	76.9%

The average length of patrol is:
- Main Harbor 1.33 hrs.
- Coastal and Contiguous Zone 2.95 hrs.

Detections per patrol:
- Main Harbor .224
- Coastal and Contiguous Zone .150

Detections per patrol hour:
- Main Harbor .169
- Coastal and Contiguous Zone 0.051

flight hours are not broken down by aircraft type on this report. The HH-52A had a total of 72 MEP missions and 67 missions (93% of total missions) were San Francisco Harbor patrols. Between the HU-16E and the HC-13B there were 35 missions in MEP with 20 missions (57% of total missions) coastal and contiguous zone patrols.

By using aircraft operating costs, based on resource hours by aircraft type, a cost per detection can be obtained. The U. S. Coast Guard aircraft operating costs effective 1 April 1974 are included as Appendix B. The cost per detection for the quarter by aircraft type and location are as follows:

Table VII

Cost Per Detection for Air Station San Francisco
for Quarter Ending 31 March 1974

	A/C Type	Detections	Flight Hours	Cost	Cost/Detection
Harbor Patrol (S. F. Harbor)	HH-52A	15	89	$44,000	$2,900
Coastal and Contiguous Zone Patrol	HU-16E	3	59	$40,000	$13,300
	HC-130B	--	0	---	
Total		18		$84,000	$4,670

It should be noted that the number of detections (eighteen) on the Port Safety/Marine Environmental Protection Activity Report do not agree with the number (fifteen) in the Pollution Incident Reporting System. One reason for the higher number of detections on the Port Safety/Marine Environmental Protection Activity Report is that the incident was already reported by another source before the Coast Guard Aircraft detected it. The PIRS report is usually filled out by the Marine Safety Office handling the spill and the detection is credited to the first source reporting it to the Coast Guard. The second reason could be a communication breakdown between the Marine Safety Office and the Air Station as to which one will fill out the PIRS report, and the report just does not get filed. The only PIRS reports that are filled out by the Air Station are their own detections, which are not responded to by the Marine Safety Office. The only Coast Guard involvement was detection by a Coast Guard aircraft. A third possible reason is that some of the detections claimed

on the Quarterly PSS/MEP report were not in the Twelfth District. This is possible because San Francisco Air Station has monthly Marine Science flights to the San Diego, California area.

Information for Tables VIII and IX was obtained from PIRS data by using the commercial computer programs from Statistical Package for Social Sciences (SPSS). The subprogram FREQUENCIES and CROSS-TABS were utilized, and an example of the SPSS computer program output is enclosed in Appendix D. The assumption is made that all Coast Guard aircraft detected pollution incidents in the 12th Coast Guard District were from Air Station San Francisco. This assumption proved to be valid by checking all the "blue sheets" manually for the date and whether helo or fixed wing responded (checked against PIRS data). The only discrepancy was that one detection in San Francisco Harbor was listed as a helicopter detection in the PIRS data base and the "blue sheet" data indicated it as a fixed wing aircraft.

Table VIII

Data on Helo and Fixed Wing-detected Spills from Aircraft at Air Station San Francisco by Data Field from PIRS for Quarter Ending 31 March 1974

1. Number detected -

Helo:11, which is 8% of total detections from all reporting sources.

Fixed Wing:4, which is 3% of total detections from all reporting sources.

2. Day - There was no discernable pattern to detections on working days (Monday thru Friday). One spill was detected on Saturday.

3. Hour - Detections were evenly distributed between the hours of 0800-1600.

4. Water Body - All 11 helo-detected spills were in San Francisco Harbor, one was within the base line to 3 miles offshore, one was 3 miles to 12 miles offshore, and one was 12-50 miles offshore. These spills detected offshore made up 43% of the total incidents detected offshore.

5. Source of Spill -

   Helo: 2 from on-shore facilities and 9 unknown

   Fixed Wing: 2 from vessels and 2 unknown

6. Cause of Spill -

   Helo: 1 tank overflow, 1 equipment failure (hose rupture) and 9 unknown

   Fixed Wing: all 4 unknown

7. Operation -

   Helo: 1 transfer of oil and 10 unknown

   Fixed Wing: 1 other vessel-related activity and 3 unknown

8. Material Spilled -

   Helo: 1 gasoline, 1 light diesel, 2 unidentified light oil, 1 unidentified heavy oil, 1 incinerator residue and 5 unknown

   Fixed Wing: 1 heavy crude, 1 unidentified light oil and 2 unknown

9. Quantity of Spill -

Helo: one 3 gallons, one 20 gallons, and 9 unknown

Fixed Wing: one 50 gallons and 3 unknown

10. Time Elapsed Between Occurrence and Detection -

Helo: 9 immediate and 2 unknown

Fixed Wing: 1 immediate and 3 unknown

11. Anticipated Response (clean up) - All CG detected spills had no clean up response and were dissipated by weather.

Table IX

Twelfth Coast Guard District PIRS General Information
On All Incidents for Quarter Ending 31 March 1974

TOTAL INCIDENTS - 140

1. Day - Spill detections were evenly distributed during weekdays with a slight decreasing trend over weekends.

2. Hour - 75% of the spills were detected between the hours of 0900-1600.

3. Water body - 15% inland, 80% harbor area, 5% offshore.

4. Source - 28% vessel, 30% onshore (7% marine facility, 6% land transportation vehicles, 3.5% land transportation facilities, 15% pipeline, and 13% onshore nontransportation facilities), 3.5% natural source (e.g., natural seepage), and 38.5% unknown source.

5. Cause - 18% structure and equipment failure (of these 24% had personnel error as a contributing factor), 28.5% personnel error (unintentional discharge), 6% natural phenomenon, 44% unknown.

6. Operation - 26.5% no operation in progress, 3% nontransportation operation, 19% facility and land related, 20% vessel related, 31.5% unknown.

7. Material - 75% oil or petroleum product, 3% liquid chemical, 1% incinerator residue, 1% natural, 2% other, 18% unknown.

8. Quantity - 34% unknown, total gallons spilled, 57,965. One spill was 42,000 gallons or 72% of total volume.

9. Notifier - 16.5% of spiller himself, 26.5% Coast Guard, 22% other government agencies, 16.5% commercial vehicles and facilities, 16.5% private individuals, 2% anonymous.

10. Time elapsed between occurrence and discovery - 58% immediate, 18% within one hour, 5.5% within 6 hours, .5% within 12 hours, 3% within 48 hours, .5% within one week, and 14.5% unknown.

11. Anticipated response

    a. By number of spills, 26.5% some clean up, 63.5% no response.

    b. By total gallonage, 92% some clean up effort was done. If the 42,000 gallon spill is disregarded, approximately 70% of volume had some clean up effect.

12. General - Of all Coast Guard detected spills, 13.5% had some clean up effort.

The PIRS data indicated that very few of the incidents were in the coastal and contiguous zone areas. Out of the 140 total spills, only 7 were detected in these areas and of these 7 the Coast Guard fixed-wing

detected three spills. Even though the return for the Coast Guard offshore patrols compared to harbor patrols was less, the offshore patrols had a higher percentage of total spills reported in its area.

Comparing the information on Coast Guard aircraft-detected incidents to overall incidents, a general check for large differences between the two can be made. One important fact is that all of the Coast Guard detected spills had no clean-up response. In other words, the Coast Guard spent $84,000 detecting 15 pollution incidents for which no clean-up effort was expended. Detecting the spills has not resulted in any damage reduction. This should be very disturbing to the program manager. However, this view is narrow in that it does not take into account the deterrence effect or spill prevention that is generated by the patrols. The amount of prevention gained by a pollution patrol is subjective and is open to interpretation. Attempting to quantify the deterrence by experimentation is very difficult on any large scale that would be meaningful. In the deterrence area of pollution incidents, there are many variables and their relationships complex. To isolate the true effect of Coast Guard aircraft patrols would be very difficult if not impossible. The problem of when the increase or decrease in pollution patrols would take effect on the population would also have to be addressed.

A tool that may possibly help evaluate some effect of Coast Guard aircraft pollution patrols is the plot described in Chapter III and

enclosed as Appendix C. The plots used were for the calendar year time period and utilized data from PIRS. Plots of pollution incidents showing all the incidents, spiller-detected incidents, Coast Guard helo-detected incidents, and Coast Guard fixed-wing aircraft respectively, are included. Comparing the different plots yields some interesting results. Almost all of the spiller-detected incidents are in the central area of the San Francisco Harbor. Coast Guard helo-detected spills were in the same general area. Thus, it is possible that the Coast Guard harbor patrols are causing people to report their own spills.

Table X examines the cost per detection concept for Air Station San Francisco during a one year time period. A hidden assumption of the cost per detection measure of effectiveness is that all detections are considered to be of equal value.

Appendix F utilizes data from the PIRS master file for the years 1973 and 1974. The files are on magnetic tape and the Statistical Package for Social Sciences (SPSS) computer programs were utilized to extract the information. Characteristics of pollution incidents are shown for two areas, nationwide and the Twelfth Coast Guard District. Within each area the incidents' characteristics were examined on three different levels: all incidents in the area, all Coast Guard detected incidents in the area, and Coast Guard aircraft-detected incidents in the area. The breakdown of information in this form enables one to examine Coast Guard aircraft-detected incidents in the Twelfth District and to compare those characteristics with all of the incidents in the area

and in the nation. This breakdown of data would allow the Coast Guard Air Station to evaluate its detections in comparison to other detections in the area and nationwide.

Table XI lists a breakdown of who detected the incidents for the nationwide and Twelfth Coast Guard District areas. Also, the table lists a detailed breakdown of Coast Guard detected incidents in both areas.

TABLE X

BREAKDOWN OF COST/DETECTION AT
CG AIR STATION SAN FRANCISCO FOR
THE YEAR ENDING 31 MARCH 1975

	Detections	Flight Hours	Cost for hrs.	Cost/detection
HH-52A	7	71	$35,100	$5010
HU-16E	10	56	$38,000	$7100
HC-130		25	$33,000	
Subtotals for quarter ending 31 March 1975	17	xxx	$106,000	$6240
HH-52A	21	78	$38,500	$1830
HU-16E	2	49	$33,200	$23,000
HC-130		10	$13,200	
Subtotals for quarter ending 31 Dec. 1974	23	xxx	$84,900	$3690
HH-52A	11	103	$50,900	$4630
HU-16E	0	120	$81,400	Infinite
HC-130		3	$4000	
Subtotals for quarter ending 30 Sept. 1974	11	xxx	$136,300	$12,390
HH-52A	10	117	$52,800	$5280
HU-16E	1	24	$16,300	$58,500
HC-130		32	$42,200	
Subtotals for quarter ending 31 Jun. 1974	11	xxx	$116,300	$10,570
Year Totals				
Helo	49	369	$182,300	$3720
Fixed wing	13	xxx	$261,300	$20,100
All Aircraft	62	xxx	$443,600	$7155

FOOT NOTES

1. Data obtained from CGAS San Francisco's PSS/MEP Quarterly Report and Quarterly Abstract of Operations.

2. Generalizations of Table
   A. All main harbor flight hours were HH-52A-Helo.
   B. All coastal and contiguous zone flight hours were fixed wing aircraft HU-16E and HC-130.
   C. Only output of patrol is dectections not deterence.

3. Costs per flight obtained from aircraft operating cost published by CG office OSR-2, effective 1 April 1974. (Costs/hr, HH-52A-$494, HU-16E-$678, and C130-$1320.

TABLE XI

BREAKDOWN OF NOTIFIER FROM PIRS DATA
WITHIN THE COAST GUARD

	1973 Nation-Wide	1974 Nation-Wide	1973 12th CG District	1974 12th CG District
Total Detected	2888(100)	3141(100)	188	146
Percent of Total in Area	23.1	21.7	28.5	24.3
CG Fixed-Wing Aircraft	44(1.5)	82(2.6)	3(1.6)	5(3.5)
CG Helicopter	958(33.2)	1004(32.0)	52(27.6)	41(28.1)
CG Ship	144(5.0)	221(7.0)	6(3.2)	10(6.8)
CG Boat	266(9.2)	334(10.6)	11(5.9)	14(9.6)
CG Shore Unit	421(14.6)	327(10.4)	56(29.8)	32(21.9)
CG Personnel Engaged in MEP Function	1004(34.8)	1107(35.2)	59(31.4)	33(22.6)
CG Personnel Off-Duty	24(0.8)	52(1.7)	- -	11(7.5)
CG Auxiliary	27(0.9)	14(0.4)	1(0.5)	- -

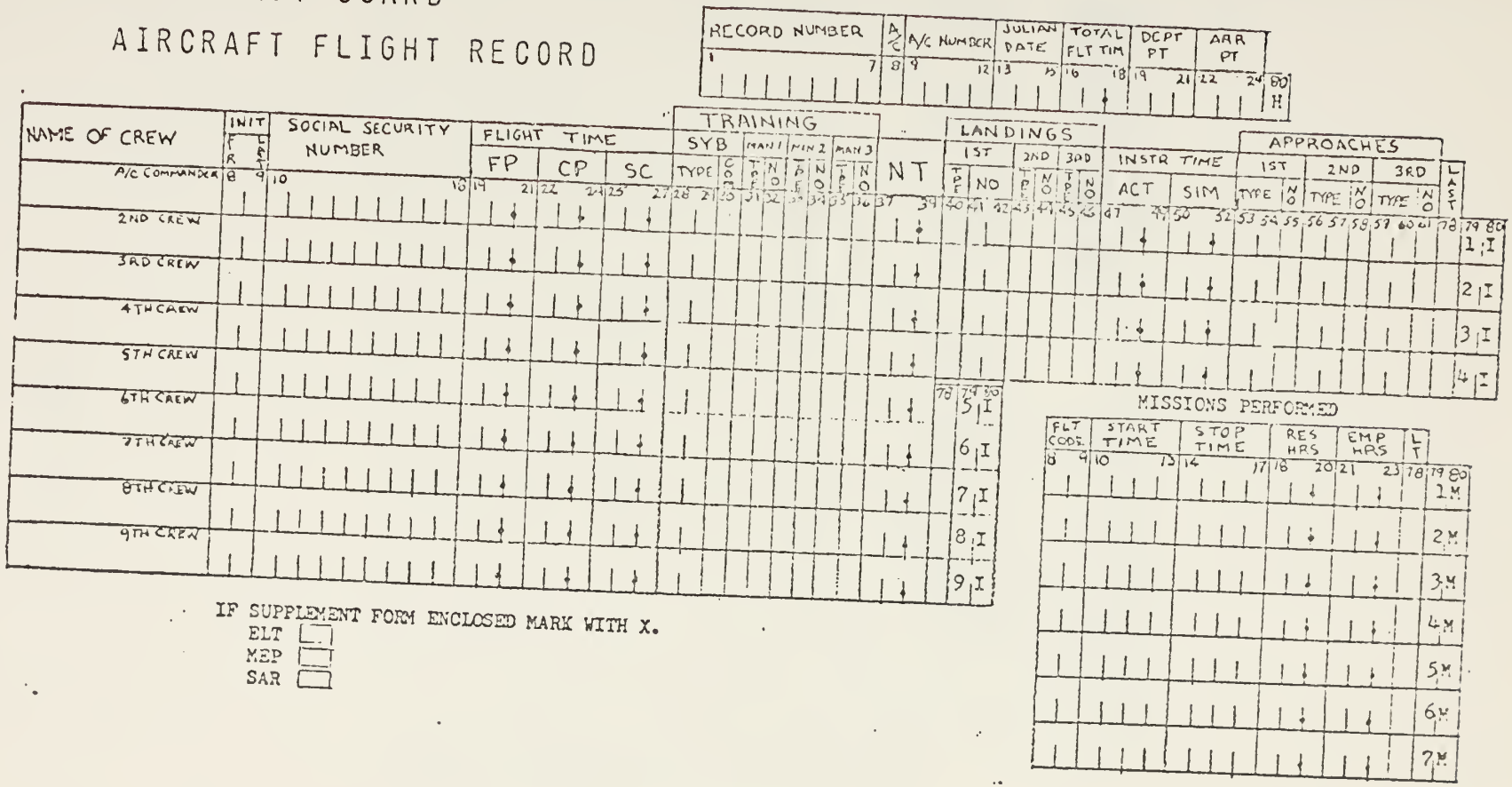
	NOTIFIER WITH AREA			
	1973 Nation-Wide	1974 Nation-Wide	1973 12th CG District	1974 12th CG District
Notifier Spiller	4554(33.6)	5406(37.4)	79(12.0)	109(18.2)
All Coast Guard	2887(21.3)	3141(21.7)	188(28.5)	146(24.3)
Federal, State, Local, Gov't	1383(10.2)	1460(10.1)	116(17.6)	128(21.3)
Private Sector	3470(25.6)	3830(26.5)	237(35.9)	198(33.0)
Unknown	1233(9.1)	632(4.4)	40(6.0)	19(3.2)

V. PROPOSED POLLUTION REPORTING SYSTEM FOR AIRCRAFT

In the previous chapters, the present pollution reporting system has been examined. This examination has shown that a need exists for more detailed information for the manager of the aircraft pollution detection program to obtain a more effective and efficient program. It is important to evaluate the information at the air station level because it forms the operational base of the system. With information at the unit level, action and solutions can be applied to individual air stations instead of the present nation-wide standards and policy setting.

More detailed information will have to be obtained from the pilots of the aircraft detection patrols. In order to make this recording of information easier for the pilot, standard throughout the Coast Guard and applicable to future automation of the information system, new forms were developed and are shown as figures 9 and 10. Even though the forms are designed for the information to be keypunched on computer cards, the forms could be used in the present manual system. The proposed file descriptions are enclosed as Appendix G. They could be utilized for batch processed, sequential file on magnetic tape. Also, the file description could be used if random access devices were used for the system and an inverted or threaded file design selected.

U.S. COAST GUARD
AIRCRAFT FLIGHT RECORD



IF SUPPLEMENT FORM ENCLOSED MARK WITH X.

ELT ☐

MEP ☐

SAR ☐

Figure 9

U.S. COAST GUARD
AIRCRAFT FLIGHT RECORD
MEP SUPPLEMENT FORM

RECORD NUMBER	SENSOR
1 7	8 12

AREA CODE	START TIME	STOP TIME	RES HRS	EMP HRS	DETECTIONS T Y	H D	PIRS ID	LAST	
13 17	18 21	22 25	26 28	29 31	32	33	34 40	78	79 80
									1 P
									2 P
									3 P
									4 P
									5 P
									6 P
									7 P
									8 P
									9 P

Figure 10

A. PROPOSED FORMS

The proposed forms provide spaces to record data which are not available from the present "blue sheets." The primary form (figure 9) collects the same information that is being collected on the present "blue sheet" with the addition of individual social security numbers and record number. The proposed form has spaces for recording individual training by syllabus code and maneuvers, and provides spaces for chronological recording of missions performed on the flight. This form would be filled out for every flight. The supplement forms would be filled out only when specific missions were performed.

The enclosed proposed supplement form (figure 10) is for the Marine Environment Protection program, specifically the detection element. It provides information as follows:

1. Type sensors on aircraft.
2. Specific area being patrolled.
3. Resource and employment hours spent in each area.
4. Detections by type, how it was detected (e. g., visual, SLAR), and PIRS sequence number.

The specific data fields on each form are described below.

Main Aircraft Flight Record

1. Record Number: Seven digit numbers with the first two digits identifying individual air station and last five digits identifying individual records. Each air station will start at 0001 and issue the individual record number sequentially for each flight flown by the air station aircraft.

2. A/C is the type of aircraft by the following one digit code

   1 HH-52A
   2 HH-3F
   3 HU-16E
   4 HC-130B
   5 HC-130H
   6 HC-130E
   7 VC11A
   8 VC4A

3. A/C Number: Four digit side number of the aircraft.

4. Julian Date: Three digit date.

5. Total Flight Time: Total actual flight time of the aircraft (total resource hours).

6. DEPT PT: Three characters for FAA designation for point of origination of the flight.

7. ARR PT: Three characters for FAA designation for point of termination for the flight.

   [Name of Crew: Print the name of crew member. This will not be recorded on computer cards but will be utilized for manual reading of the form.]

8. INIT: Two characters for first name and last name initial of the individual crew member.

9. Social Security Number: Nine digits to record individual crew members' social security number.

10. Flight Time:

    a) FP: first pilot time.
    b) CP: copilot time.
    c) SC: special crew time.

11. TRAINING:

a) SYB: two characters for recording the syllabus the individual was performing. The first character codes are:

S-SAR aircrew
R-Recurrent training
A-Aircraft Commander
F-First pilot
C-Copilot

The second character is the designated number flight in the above categories.

b) COM: one character completion code for the syllabus

C-complete
I-incomplete

12. MAN 1
13. MAN 2
14. MAN 3

two characters each to record specific maneuvers performed.

a) TPE: the first character for the type maneuver using the following code:

A Autorotation
S Single engine
D Ditch drill
B Bailout
F Fire drill
P Platform pickup
H Hoists

b) NO: one character to record the number of times the maneuver was performed.

15. NT: three digits to record the night time for each individual.

16. LANDINGS: to record the type and number of landings performed by the individual. There are spaces allowed for three types of landings.

a) TPE: type of landing by following code:

1 Touch and go, land.
2 Full stop, land.
3 Touch and go, ship.
4 Tie down, ship.
5 Water

b) NO: the number of landings of that type performed.

17. INSTR. TIME: the recording for instrument time performed.

a) ACT: actual
b) SIM: simulated

18. APPROACHES:

1st
2nd three characters to record specific instrument
3rd approach performed.

TYPE: using the following codes for first character:

F ADF
G GCA
I ILS
L LF
O OMNI
R RADAR
C LOC

using following codes for second character:

A actual
S simulated

NO: the number of instrument approaches of that type performed.

19. LAST: one character to mark with x if last individual on list.

79 and 80 are the individual numbers and individual coding (I)

which are preprinted on the form.

MISSION PERFORMED SECTION OF MAIN FORM

20. FLT CODE: two digit code for mission category (same as presently used aircraft flight record).
21. START TIME: four digits to record time commenced performing mission.
22. STOP TIME: four digits to record time ceased performing mission.
23. RES HRS.: three digits to record resource hours for the mission category.
24. EMP HRS.: three digits to record employment hours for the mission category.
25. LT: one character to mark with x if last mission recorded.

Columns 79 and 80 are mission number and mission wording (M), which are preprinted on each form.

A row will be filled out for each different mission flown in chronological order. If a mission is flown for two different times during the flight, it will require two entries.

MEP SUPPLEMENT FORM

The MEP supplement form will be filled out only if a MEP detection mission is flown. A new entry will be made for each area or if more than one detection is made in the same area.

1. RECORD NUMBER: 7 digits, the same number as on the main form.

2. SENSOR: five digits to record what sensors are being used by the aircraft. The number 00001 would mean visual only with the code for other sensors such as side-looking radar to be developed as the equipment becomes operational.

3. AREA CODE: five digit code to record what area is patrolled. The last three digits are the same code as the PIRS water body code. The first two digits would be the code for specific areas to be specified by the MEP program manual (e.g., San Francisco Harbor, Monterey Harbor, etc.). This area designation would be published on a national chart which would be easily read for use in the cockpit.

4. START TIME: 4 digit code to record the beginning of the patrol of an area.

5. STOP TIME: 4 digit code to record the end of the patrol of an area.

6. DETECTIONS: to record information on a pollution detected.

   a) TY: one digit to record the type of detections. A suggested code would be an ordinal scale measure of the value of the detections. The detections should be broken into four main categories: harbor and inland area, territorial seas, contiguous zone, and prohibited zone. Each of these location categories should be further broken down into ordinal values that are categorized by location, area and volume of incident. Figure 11 is enclosed to show the table of ordinal values. All

ORDINAL SCALE FOR VALUE
OF
POLLUTION DETECTION

LOCATION AREA	VOLUME IN GALLONS					
	10 and less	11 to 100	101 to 1000	1001 to 10000	10001 to 100000	more than 100000
HARBOR and INLAND	1	2	3	4	5	5
TERRITORIAL SEA (0-3 miles offshore)	1	1	2	3	4	5
CONTIGUOUS ZONE (3-12 miles offshore	1	1	1	2	3	4
PROHIBITED ZONE (12-50 miles offshore)	1	1	1	1	2	3

NUMBER CLASSIFICATION

5-major
4-medium
3-minor
2-low minor
1-trivial

THE HIGHER THE NUMBER THE MORE VALUE OF DETECTION

Figure 11

measures of effectiveness using cost per detection assume that the value of all detections are the same. In reality, this assumption is completely false. The volume and location values are based on classification of incidents in Federal Register Volume 40, data analysis from PIRS, and the author's adaptation. This scale only gives equality, greater and/or less than values. It is not possible to tell exactly how much more value a 1000 gallon spill detection in inland waters has than a 100 gallon spill detection. This table provides an estimate of value of detections, given location and volume. There is need for further research in this area to devise a criterial scale for the value of detection, given location and volume. Also, the type of material spilled could be considered as a value variable.

b) HD: one digit to code to record how the pollution was detected (e.g., visual, SLAR, etc.). Coding for this entry is 1 for visual with others to be developed as equipment becomes operational.

c) PIRS ID: seven digit PIRS sequence number assigned to the spill. This number would be received from the district MEP office during working hours and RCC otherwise on completion of the flight. This will be done by the aircraft commander or the operations duty officer.

7. LAST: one digit to mark with an x if it is the last entry on the mission.

NOTE: Columns 79 and 80 are MEP number and MEP coding (P) respectively.

An example demonstrating the use of the forms is given below. First, a brief narration of the flight is given. An H-3 aircraft is scheduled for a four hour training flight for pilot upgrading and SAR aircrew training for two trainees. Arrangements were made for work with a Coast Guard boat half way through the flight. MEP detection time is recorded for the flight when the aircraft is over water and, in the discretion of the aircraft commander, is able to detect pollution (i.e., not being completely absorbed in the assigned training mission). One hour into the flight, the aircraft was diverted on an overturned sailboat SAR case and was recalled after one half hour (before reaching the scene). The aircraft then returned to training. After working with the boat, the aircraft commander flew two practice instrument approaches at home field before terminating the flight.

Consider the two forms enclosed as figures 12 and 13 to see how this flight was recorded. The heading and flight time is self-explanatory. LTJG Smith completed his aircraft commander syllabus flight number four and made seven hoists, six platform pickups and three autorotations. The two SAR aircrewmen trainees logged training with Black completing the syllabus number five. Both trainees performed a bailout drill. The

Example of Proposed U. S. Coast Guard Flight Record Form

U.S. COAST GUARD

AIRCRAFT FLIGHT RECORD

RECORD NUMBER (1–7)	A/C (8)	A/C NUMBER (9–12)	JULIAN DATE (13–15)	TOTAL FLT TIM (16–18)	DEPT PT (19–21)	ARR PT (22–24)	80
011-1324 5	2	1470	324	4.0	FMH	FMH	H

NAME OF CREW	INIT (8–9)	SOCIAL SECURITY NUMBER (10–18)	FLIGHT TIME FP (19–21)	FLIGHT TIME CP (22–24)	FLIGHT TIME SC (25–27)
A/C COMMANDER LCDR ADAMS	EA	301014001	1.0	3.0	
2ND CREW LTJG SMITH	JS	211121450	3.0	1.0	
3RD CREW AD1 DOE	JD	312123450			4.0
4TH CREW AT 3 WILLIAMS	CW	414544670			4.0
5TH CREW AM-3 WHITE	RW	378675460			4.0
6TH CREW AD-3 BLACK	AF	421356780			4.0
7TH CREW					
8TH CREW					
9TH CREW					

NAME OF CREW	TRAINING SYB TYPE (28–29)	SYB C/O (30)	MAN 1 T (31)	MAN 1 NO (32)	MAN 2 T (33)	MAN 2 NO (34)	MAN 3 T (35)	MAN 3 NO (36)	NT (37–39)	LANDINGS 1ST T (40)	1ST NO (41–42)	2ND T (43)	2ND NO (44)	3RD T (45)	3RD NO (46)
ADAMS			A	1						2	01				
SMITH	A4	C	H	7	A	3	P	6		2	05	5	6		
DOE															
WILLIAMS															
WHITE	S4	I	H	2	P	3	B	1							
BLACK	S5	C	H	5	P	3	B	1							

NAME OF CREW	INSTR TIME ACT (47–49)	INSTR TIME SIM (50–52)	APPROACHES 1ST TYPE (53–54)	1ST NO (55)	2ND TYPE (56–57)	2ND NO (58)	3RD TYPE (59–60)	3RD NO	LAST (78)	79	80
ADAMS		0.4	IS	1	FS	1				1	I
SMITH										2	I
DOE										3	I
WILLIAMS										4	I
WHITE										5	I
BLACK									X	6	I
7TH CREW										7	I
8TH CREW										8	I
9TH CREW										9	I

MISSIONS PERFORMED

FLT CODE (8–9)	START TIME (10–13)	STOP TIME (14–17)	RES HRS (18–20)	EMP HRS (21–23)	LT (76)	79–80
14	1000	1100	0.7	1.0		1M
11	1024	1100	0.3	0.5		2M
07	1100	1310	0.5	0.5		3M
14	1310	1400	2.1	2.5		4M
11	1236	1324	0.4	0.3	X	5M
						6M
						7M

IF SUPPLEMENT FORM ENCLOSED MARK WITH X.

ELT [ ]
MEP [X]
SAR [X]

Figure 12

Example of Proposed U. S. Coast Guard MEP Supplement Form

U.S. COAST GUARD
AIRCRAFT FLIGHT RECORD
MEP SUPPLEMENT FORM

RECORD NUMBER (1–7)	SENSOR (8–12)
0 1 1 3 2 4 5	0 0 0 0 1

AREA CODE (13–17)	START TIME (18–21)	STOP TIME (22–25)	RES HRS (26–28)	EMP HRS (29–31)	DETECTIONS TY (32)	DETECTIONS HD (33)	DETECTIONS PIRS ID (34–40)	LAST (78)		
2 1 2 0 8	1 0 2 4	1 1 0 0	0 3	0 5	1	1	0 1 1 0 0 1 2 3		1	P
2 1 2 0 8					1	2	0 1 1 0 0 1 2 4		2	P
2 1 2 0 8	1 2 3 6	1 3 0 0	1 0 2	1 0 4	1	1	0 1 1 0 0 1 2 5		3	P
2 2 2 0 8	1 3 0 0	1 3 2 4	1 0 2	1 0 4				X	4	P
									5	P
									6	P
									7	P
									8	P
									9	P

Figure 13

aircraft commander demonstrated one autorotation and flew two practice instrument approaches, an ILS and an ADF. The landings were one land full stop for the aircraft commander and five for the copilot Smith. Smith also had six water landings.

Now examine the mission flown part of the main form. Note that the missions are logged in chronological order as flown. MEP time was recorded when the aircraft was over water and was able to detect pollution by discretion of the aircraft commander. When the aircraft was diverted, only the SAR mission was being performed. The employment hours and resource hours currently are calculated by the pilot, but if automated in the future, this computation could be accomplished by the computer. Then the pilot would record only the start and stop time for each mission.

The MEP and SAR supplement form boxes were marked because both missions were performed on the flight. Figure 13 shows the completed MEP supplement form for the flight. Note the record number is the same as on the main form. The only sensor equipment was visual. Two areas numbered 21 and 22 in the Atlantic territorial sea (208) were flown over by the aircraft during the MEP detection mission. The double entry for the same area is because two detections were located in the same designated area during the same time period logged. When recording the second detection, only the area code and information about the detection is filled out. The third entry for the same area is for reentering the area after the SAR case. The fourth entry was because

of entering a new area. The resource and employment hours are calculated the same way as the missions performed. The MEP supplement form is a further breakdown by area and detections of the MEP time recorded in Mission Performed section of the main form. Again, if and when the system becomes automated only start and stop time would be needed for each area and the computer would calculate the resource and employment hours for each area.

B. AIRCRAFT FLIGHT RECORD NUMBER PIRS DATA BASE

The Coast Guard-detected incidents in the PIRS data base should have the aircraft flight record number of the detecting source. This record would eliminate the need for present assumptions and "detective work" necessary to limk the Coast Guard aircraft-detected incidents to the air station to which the aircraft was attached. Presently there are some pollution patrols conducted by air stations across district boundaries (which will most probably increase with the arrival of the new MRS jet aircraft). This increase will make evaluation of surveillance at district level difficult because some resource inputs will be from outside the district.

The new flight record contains the PIRS sequence number and would allow a link to the PIRS data on incidents detected by an individual air station. The addition of the flight record number to the PIRS data would allow a link into the aircraft flight records from the Pollution Incident Reporting System and enhance analysis of the individual flights that found

detections. Addition of the operating facility number (OPFAC) to the PIRS data base for Coast Guard-detected spills other than aircraft would allow evaluation of detections at unit levels in the non-aviation community. This addition will result in the same benefits as evaluating by individual air stations.

C. FURTHER BREAKDOWN OF MARINE ENVIRONMENTAL PROTECTION FLIGHT CODE

Presently, all flights that are performing any mission in the Marine Environmental Protection Program are categorized in one flight code, 11. It would be beneficial to break this into two main categories in the aircraft MEP mission: 1) detection/surveillance and 2) response. This will give an accurate figure as to the aircraft resources spent responding to incidents already detected. These two categories could be broken down further into: 1) hours spent actively performing mission, 2) hours spent in support of the mission, and 3) hours spent in training for the mission. This breakdown would allow the program manager to make a detailed analysis of the two main mission performances by knowing how flight hours are used in each category.

This breakdown would require a change in the Abstract of Operation form but the implementation cost would be minimal. The MEP aircraft program has two distinct missions and thus should be divided into at least two main categories. With the coming of the new MRS aircraft, which has the latest in technology pollution surveillance equipment, the

further breakdown of each of the two main categories would also be practical. This new equipment will require training and support hours which should be distinguished from the actual detection patrols. This fact will also pertain to the response category as new pollution clean-up equipment is developed. An example of usage of these new categories follows. A Cape Code aircraft is assigned a Boston Harbor Pollution Patrol. For weather reasons the aircraft has to fly over land to Boston Harbor, conduct the patrol, and return to Cape Cod. It took one-half hour enroute each way with one hour patrol. The hours should be logged 1.0 hours for MEP surveillance actual and 1.0 MEP surveillance support.

The support categories would be aircraft hours that are flown in support of one of the categories, but no actual performance of that mission is beong done on that flight leg. These flights would be such as flights to test new equipment, flights to factories for installation of new equipment, etc. The actual surveillance and response categories would be used when actually flying and able to detect pollution or the flight is in response to an actual pollution incident.

The training subcategories are self-explanatory. However, the actual and training hours in both categories could be flown simultaneously and would be treated as the resource hours and employment hours previously discussed. It is possible to fly an actual surveillance flight and instruct personnel in the operation of the surveillance equipment at the same time. It is not possible to fly in the actual category and the support category at the same time.

In researching one quarter's "blue sheets" at Air Station San Francisco, it was noted that one surveillance flight had mechanical problems and parts and maintenance personnel were flown to the downed aircraft. These flight hours were logged to MEP, but should have been distinguished separately and belong in the support category. All that was known by the MEP manager was that a larger number of C-130 hours were flown for MEP missions than was normal. There was no way of determining how these hours were utilized.

D. PROPOSED PORT SAFETY/MARINE ENVIRONMENTAL PROTECTION ACTIVITY REPORT FOR AIRCRAFT

The aircraft surveillance flight portion of this report should be removed and made a separate report to be submitted by each air station. This report would eliminate the present aggregation of air station data at the district level. Aircraft hours utilized should be expanded on this report to have both resource hours and employment hours. The patrols in each category should be broken down by aircraft type. Presently, all aircraft types are aggregated into one for each category. The difference in operating costs for type aircraft is as much as 250%. A proposed form for this report is enclosed as Figure 14. The information for this report can be obtained from the new proposed aircraft flight record examined earlier in this chapter.

When the system becomes automated, the need for the air station to submit this report would cease. The information would be available

Proposed Port Safety/Marine Environmental Protection Activities Report for Aircraft

QUARTERLY AIRCRAFT

POLLUTION DETECTION REPORT

FOR QUARTER ENDING _____

FROM AIR STATION _____

AIRCRAFT TYPE _____

LOCATION AREA	NUMBER OF DETECTIONS BY VALUE CATEGORY						RESOURCE HOURS	EMPLOY-MENT HOURS	NUMBER OF PATROLS
	1	2	3	4	5	Total			
HARBOR and INLAND									
TERRITORIAL SEA (0-3 miles offshore)									
CONTIGUOUS ZONE (3-12 miles offshore)									
PROHIBITED ZONE (12-50 miles offshore)									
TOTALS									

Figure 14

from the aircraft flight records that are already in the data base. The Abstract of Operations report would also be eliminated from submission by the air stations when the system is automated for the same reasons.

E. FEEDBACK REPORTS

All information and reports flow from the units up through the chain, ultimately to headquarters level. There the information is analyzed, with management decisions being made based on these examinations. Feedback to the district and unit level, however, does not occur. Comments were made to the author that the districts and units know what they did and therefore there is no need to send them back reports. This rationalization is completely invalid. The districts and units should know how they are performing in comparison with other districts and similar type units. An example of such a report was enclosed in Appendix F of the analysis of detections characterizing various reporting sources using the PIRS data. Another example is the plots also examined in Chapter IV and enclosed as Appendix C. These plots indicate to the units and the district the utilization of information they are providing. The plots indicate where all the spills reported in this area are located and where the spills which were reported by their district units or own units are located.

This feedback enables the districts and units to become more involved in the program, thus producing more support and commitment

to the MEP program. This increased support will help to open the communication channels in both directions at the district level between the Marine Safety Office, air stations, and district MEP offices. The MSO and air stations are the major detecting sources for the Coast Guard. Opening the communications should increase the competence of the various Coast Guard patrol platforms at the district level.

The proposed new forms, reports and additions to present reports are to provide more detailed and accessible information for the program manager. Implementation of these proposals will provide better information for management and policy decisions, thus producing more efficient and effective aircraft pollution detection patrols. This proposed management information system will help the program to obtain its primary objective of maintaining or improving the quality of the marine environment.

In the cloaks of reports, forms and analysis, the ultimate objective of the program must not be forgotten.

FOOTNOTES

1. United States Coast Guard, Aviation Plan Study Report (CG-380-2), (April 1973), p. I-MEP-1.

2. IBID.

3. U. S. Code of Federal Regulations 40-CFR 1510 Part II, "National Oil and Hazardous Substances Pollution Contingency Plan" (February 10, 1975).

4. United States Coast Guard, Organization Manual (CG-229) (Washington, D.C. 1974) p. III-1.

5. Aviation Plan Study Report, OpCit p. II-STA.

6. IBID p. I-MEP-5.

7. IBID p. II-CAP-1&2.

8. United States Coast Guard, "Instructions for CG-4957 Port Safety/ Marine Environmental Protection Activities Report," COMDTINST 5010.5 (14 September 1973).

9. United States Coast Guard, Pollution Incident Reporting System Coding Instruction Manual CG450, (Washington, D.C.) (Oct. 1973) p. 1.

APPENDIX A

COAST GUARD MARINE ENVIRONMENT ORGANIZATIONS' MISSIONS AND FUNCTIONS

This appendix lists excerpts from the Coast Guard Organization Manual (CG-229). Missions and functions are listed for Headquarter's organizations, the Office of Marine Environment and Systems, and the Marine Environmental Protection Division. The District organizations' missions and functions listed are for the Marine Safety Division and the Marine Environmental Protection Branch.

OFFICE OF MARINE ENVIRONMENT AND SYSTEMS
(G-W)

1. Mission. To establish and maintain a coordinated Coast Guard environmental program, responsive to intra-service and external requirements; and a comprehensive ports and waterways system, encompassing all aspects of marine transportation, exclusive of vessel safety.

2. Functions. Under the general direction and supervision of the Commandant, Vice Commandant, and Chief of Staff, the Chief, Office of Marine Environment and Systems shall:

   a. Serve as the Commandant's internal and external coordinator, liaison and spokesman on all environmental protection matters for which the Service has responsibility, to assure: a well-coordinated and effective Coast Guard effort in the prevention, detection and control of pollution; compliance with the Environmental Policy Act; and that required Coast Guard inputs to Departmental and interagency environmental matters are provided.

   b. Provide policy guidance for and generally direct and coordinate the following major Service-wide functions:

      (1) Manage and coordinate the Marine Environmental Protection Program as defined above, including the promulgation of policies, standards and guidelines to govern the operations of the National Strike Forces.

      (2) Establish and maintain the aids to navigation system, including short and long range aids to navigation, to meet the needs of marine and air commerce, the Armed Forces, and the boating public. Control the utilization of buoy tenders and aids to navigation facilities and structures.

      (3) Act for the Secretary of Transportation (via delegation of authority) on intra-department and external matters relating to port and water resources utilization and development for which the Department has responsibility.

      (4) Approve the location and clearance of bridges over navigable waters; and regulate the operation of drawbridges.

      (5) Establish, operate, and maintain vessel traffic systems for ports, harbors, and other waters subject to congested vessel traffic.

(6) Investigate incidents, accidents, or acts involving the loss or destruction of, or damage to structures which affect, or may affect, the safety or environmental quality of ports, harbors, or navigable waters of the United States.

(7) Manage functions relating to safety of port facilities and adjacent waters, and movement of hazardous cargo to and from commercial vessels.

(8) Enforce Federal laws on navigable waters (not included are laws specifically the responsibility of the Offices of Merchant Marine Safety and Boating Safety, as well as matters involving enforcement of maritime treaties and violations on the high seas).

c. Direct overall planning, budgeting and program evaluation, and provide for special studies, inter-Office liaison and coordination as required at the Office level.

d. Establish and maintain contacts with other Headquarters Offices concerning shared-use of facilities and required inputs to programs of Office of Marine Environment and Systems.

e. Promulgate guidelines, standards and directives governing field program management, and establish a system to enable review of effectiveness of field operations.

f. Be the Program Director for the following programs: Short Range Aids to Navigation; Loran-C; Loran-A; OMEGA; Port Safety and Security; Law Enforcement; Marine Environmental Protection; and Bridge Administration.

MARINE ENVIRONMENTAL PROTECTION DIVISION
(G-WEP)

Under the general direction and supervision of the Chief, Office of Marine Environment and Systems the Chief, Marine Environmental Protection Division shall:

a. Serve as the Program Manager for the Marine Environmental Protection Program.

b. Coordinate, plan, develop, implement, administer and monitor a system aimed at marshaling and effectively employing the applicable resources of the Coast Guard in an integrated, intensive endeavor to prevent, detect and control pollution of the marine environment in accordance with statutory requirements, the policies of the Department of Transportation, and directives of higher authority.

c. Keep appropriate Headquarters Offices advised of current information on environmental program priorities and of their responsibilities for contributing to the total program output.

d. As directed, represent the Coast Guard and present its views and position on environmental matters at meetings with officials of the Department, other government agencies and the private sector.

e. Consistent with statutory provisions and Departmental policy, arrange for and coordinate Coast Guard assistance to Federal, state and municipal agencies and private enterprise in dealing with environmental matters of mutual concern.

f. Convene meetings with the Environmental Coordinating Staff (composed of representatives from other HQ Offices) on environmental matters to obtain their views and assistance in determining a unified course of action.

g. Keep the Commandant abreast of progress of the total environmental program and informed of problems requiring his personal attention.

h. Insure Coast Guard compliance with the National Environmental Policy Act of 1969 and other related environmental laws.

i. Develop and administer the Coast Guard program to prevent, control, and abate pollution by oil, and other contaminants on waters under United States jurisdiction; issue related policy, standards and guidelines.

j. Plan, program, and budget for Coast Guard environmental protection activities.

k. Coordinate Coast Guard programs for the discharge of its obligations under interagency agreements on environmental protection.

l. Provide for, maintain, and analyze reports to determine environmental protection requirements and the effectiveness of the Coast Guard program.

m. Establish operational procedures and training requirements for Coast Guard personnel and units engaged in environmental protection activities. Prepare and maintain manuals and other controlling instructions.

n. Maintain liaison with Federal agencies which have environmental responsibilities inter-related with those of the Coast Guard.

o. Develop, coordinate and provide for Coast Guard participation regarding the Hazardous Materials Information Center and the National Pollution Control Response Center.

p. Administer the applicable sections of the Water Quality Improvement Act of 1970, Oil Pollution Act of 1965 and the Refuse Act of 1899.

MARINE SAFETY DIVISION
(m)

Under the general direction and supervision of the District Commander and the Chief of Staff, the Chief, Marine Safety Division shall:

1. Administer an integrated, multi-program system, encompassing Commercial Vessel Safety, Port Safety and Security, and Maritime Environmental Protection, in accordance with policies issued by cognizant program directors.

DISTRICT MARITIME ENVIRONMENTAL PROTECTION BRANCH
(mep)

Under the direction and supervision of the Chief, Marine Safety Division, the Chief, Maritime Environmental Protection Branch, shall:

1. Administer and supervise the Maritime Environmental Protection Program, and insure uniform and correct application of the maritime environmental laws and regulations.

2. Process and review funding and resource requirements and planning proposals for district units performing maritime environmental protection functions.

3. Administer and supervise the keeping of records (case files) of all reported spills.

4. Administer and process reported violations of the maritime environmental laws and regulations. Prepare recommendations for disposition of civil and criminal violations to the Chief, Marine Safety Division. Keep records of all fines imposed and collected.

5. Process and prepare responses to all appeals to the district commander from decisions of the Chief, Marine Safety Division. If further appeal is made to the Commandant, prepare suitable recommendations and provide all information necessary for a final decision.

6. Prepare daily reports of minor spills and POLREPS of moderate and major spills for transmission to the Commandant (G-WEP) in accordance with contingency plans and current instructions.

7. Closely monitor the effect and effectiveness of the National, Regional, and Sub-regional Contingency Plans. Maintain close liaison with signatories of the National Plan to recommend effective changes as the need arises.

8. Maintain a continuing and updated technical library of pertinent pollution and control technical documents.

9. As directed by the district commander, assume the duties as on-scene coordinator when a major spill or declared pollution incident occurs.

10. Administer, supervise, and correlate with other divisions the preparation of all Environmental Impact Statements. Prepare endorsements on Impact Statements received from other agencies for comment.

11. Coordinate the environmental protection activities of the various district units.

12. Monitor the unit training of personnel performing environmental protection activities.

13. Maintain a continuing and effective liaison with federal agencies (especially Environmental Protection Agency), state agencies, and maritime organizations and industries involved in maritime environmental protection.

14. Review data and information from field units that contribute to management information systems at district and Headquarters levels.

APPENDIX B

BREAKDOWN OF U. S. COAST GUARD AIRCRAFT OPERATING COST BY TYPE

This appendix lists all the types of aircraft in the Coast Guard inventory. For each type aircraft, the total costs for fuel and maintenance and personnel are listed. For this, an average cost per hour for each type aircraft was calculated and also listed. This table is released by Coast Guard Headquarters from the Aviation Branch of the Search and Rescue Division.

TABLE XII

U. S. COAST GUARD AIRCRAFT OPERATING COSTS
Effective 1 April 1974

ITEM	AIRCRAFT						
	C130B/E	C130H	HH3F	HH52A	HU16E	VC11A	VC4A
A/C Fuel and Maintenance							
SH30	168.6	205.4	44.0	13.9	25.7	179.5	74.8
SH41 $K	346.0	346.0	262.0	134.0	217.0	167.0	114.0
SH42	91.0	91.0	26.0	16.0	17.0	22.0	20.0
F&M Total Cost ($K)	605.6	642.4	332.0	163.9	259.7	368.5	208.8
Personnel							
Pilots							
Number	4	4	3	2	3	3	3
Cost ($K)	95.4	95.4	71.6	47.7	71.5	71.5	71.5
Aviation Ratings							
Number (Flight Pay)	21	21	12	7	10	10	10
Cost ($K)	236.3	236.3	135.0	78.8	112.5	112.5	112.5
Number (N. F. P.)	3	3	2	1	1	0	0
Cost ($K)	30.6	30.6	20.4	10.2	10.2	0.0	0.0
Gen. Service Ratings							
Number	5	5	3	2	2	2	2
Cost ($K)	51.0	51.0	30.6	20.4	20.4	20.4	20.4
Personnel Total Cost ($K)	413.3	413.3	257.6	157.1	214.6	204.4	204.4
Total Annual Cost ($K)	1,018.9	1,055.7	589.6	321.0	474.3	572.9	413.2
Planned Annual Utilization (Hours)	800	800	700	650	700	800	800
F&M Cost per Hour ($)	757	803	474	252	371	461	261
Personnel Cost per Hour ($)	517	517	368	242	307	256	256
Total Cost per Hour ($)	1,274	1,320	842	494	678	717	517

APPENDIX C

PLOTS OF TWELFTH C. G. DISTRICT POLLUTION INCIDENTS

This appendix includes examples of plots of pollution incidents for the Twelfth Coast Guard District. These plots were made on the CALCOMP Model 765. The Plotting Package of NPS IBM [Reference 6] was the software used to draw the plot. All points were stored in an array in the program which controlled the pen to draw the outlines. These plots can be very adaptive to location and type of incidents to be plotted.

COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1973 - ALL

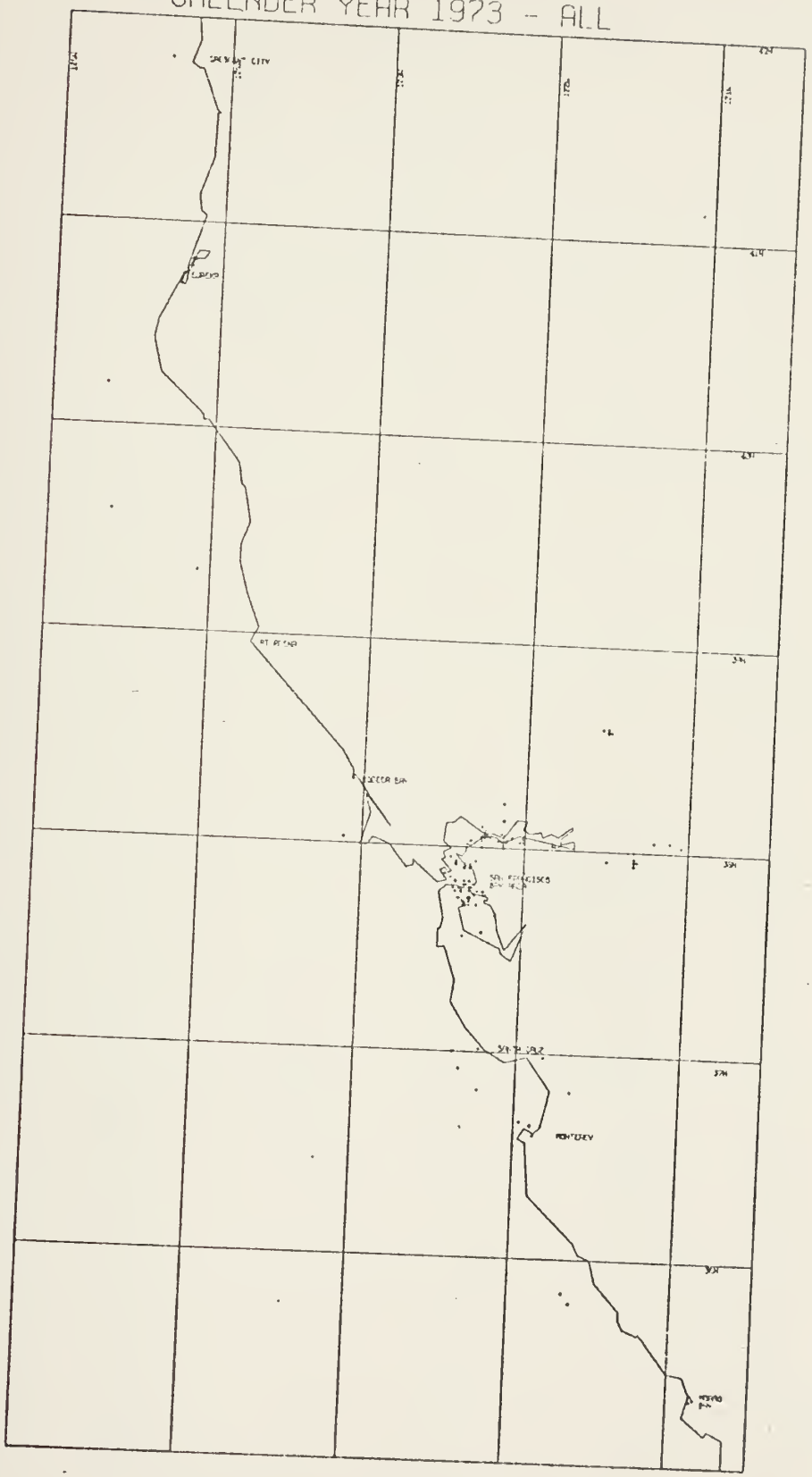


Figure 15

COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1974 - ALL

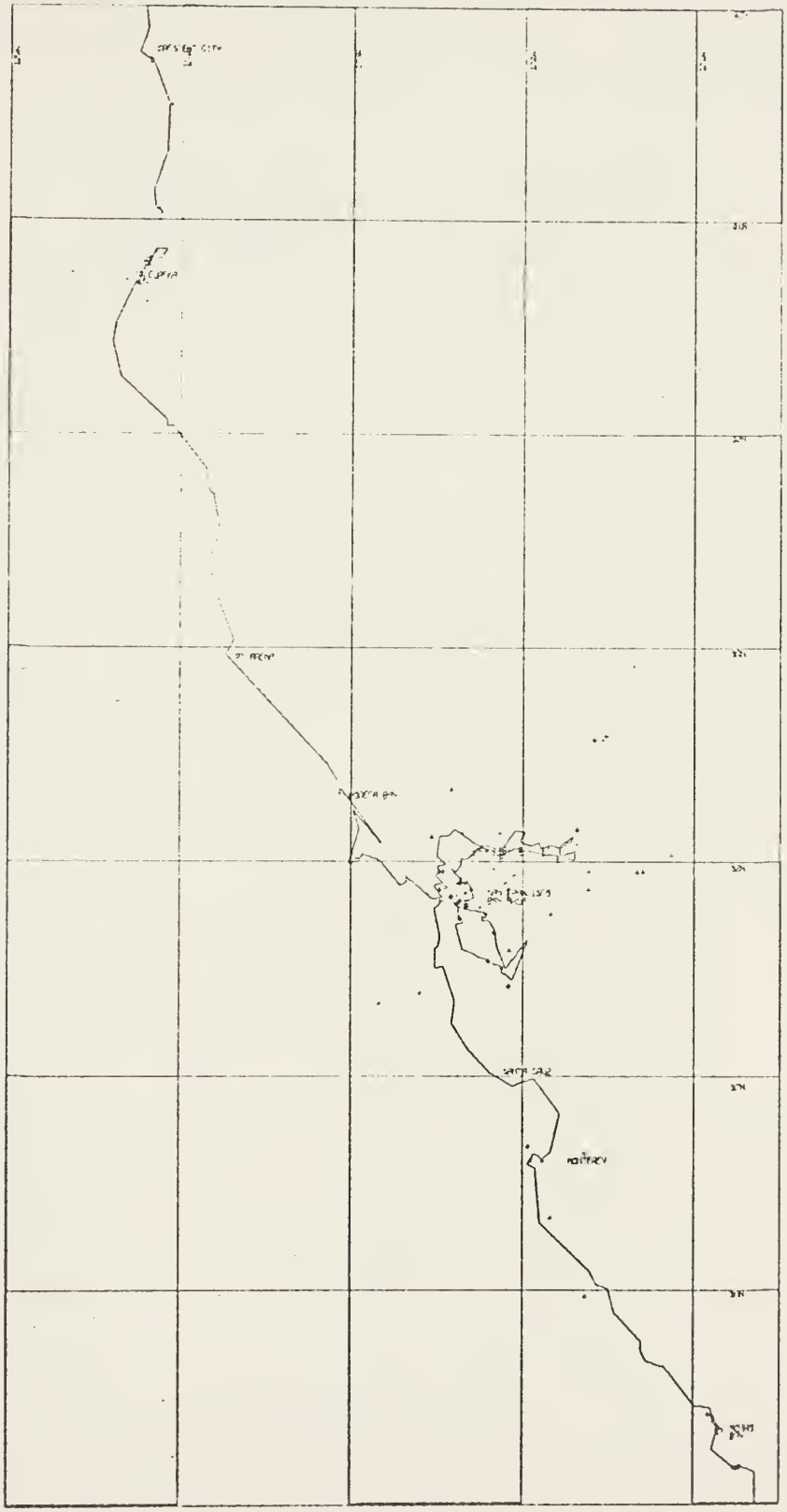


Figure 16

SAN FRANCISCO BAY AREA
POLLUTION INCIDENTS
CALENDAR YEAR 1974-ALL

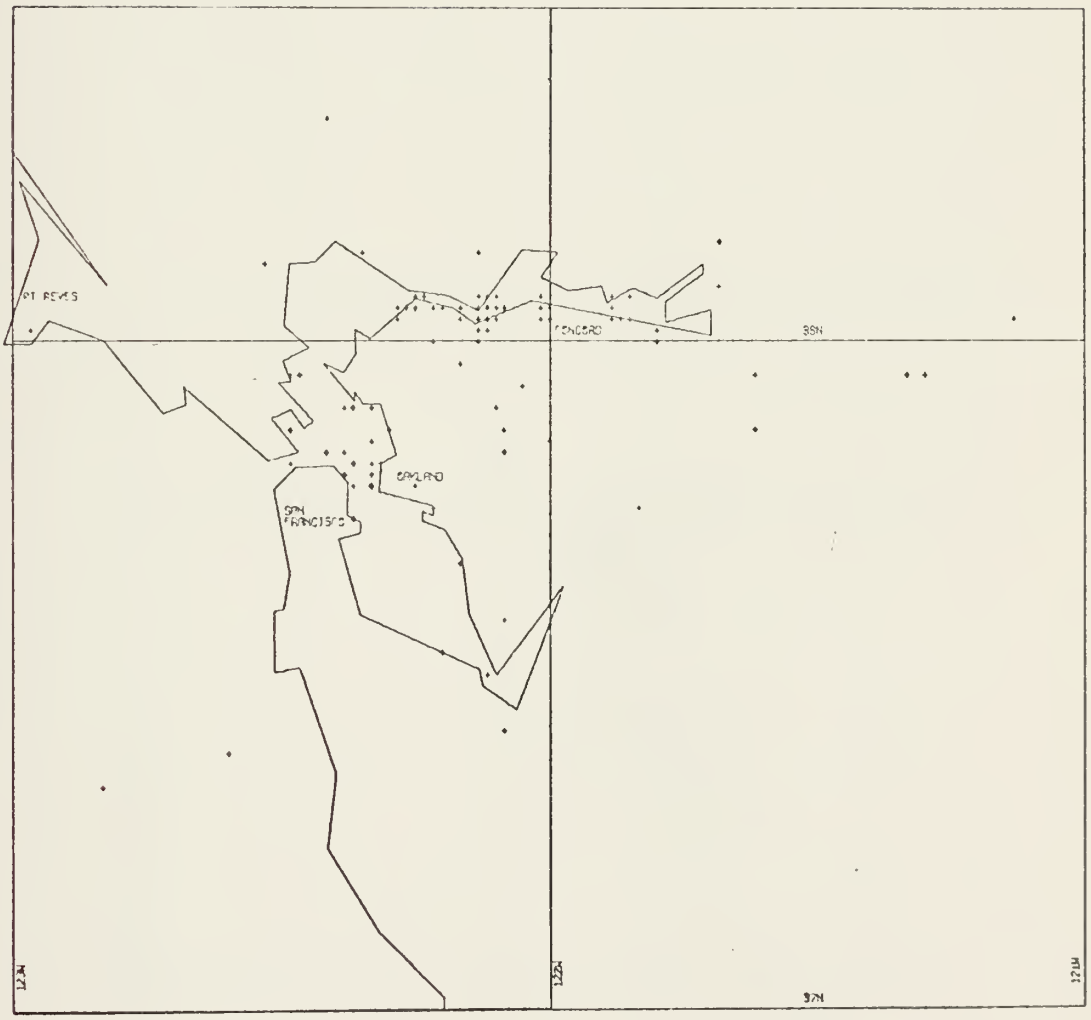


Figure 17

SOME RESPONSE ANTICIPATED
COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1974 - ALL

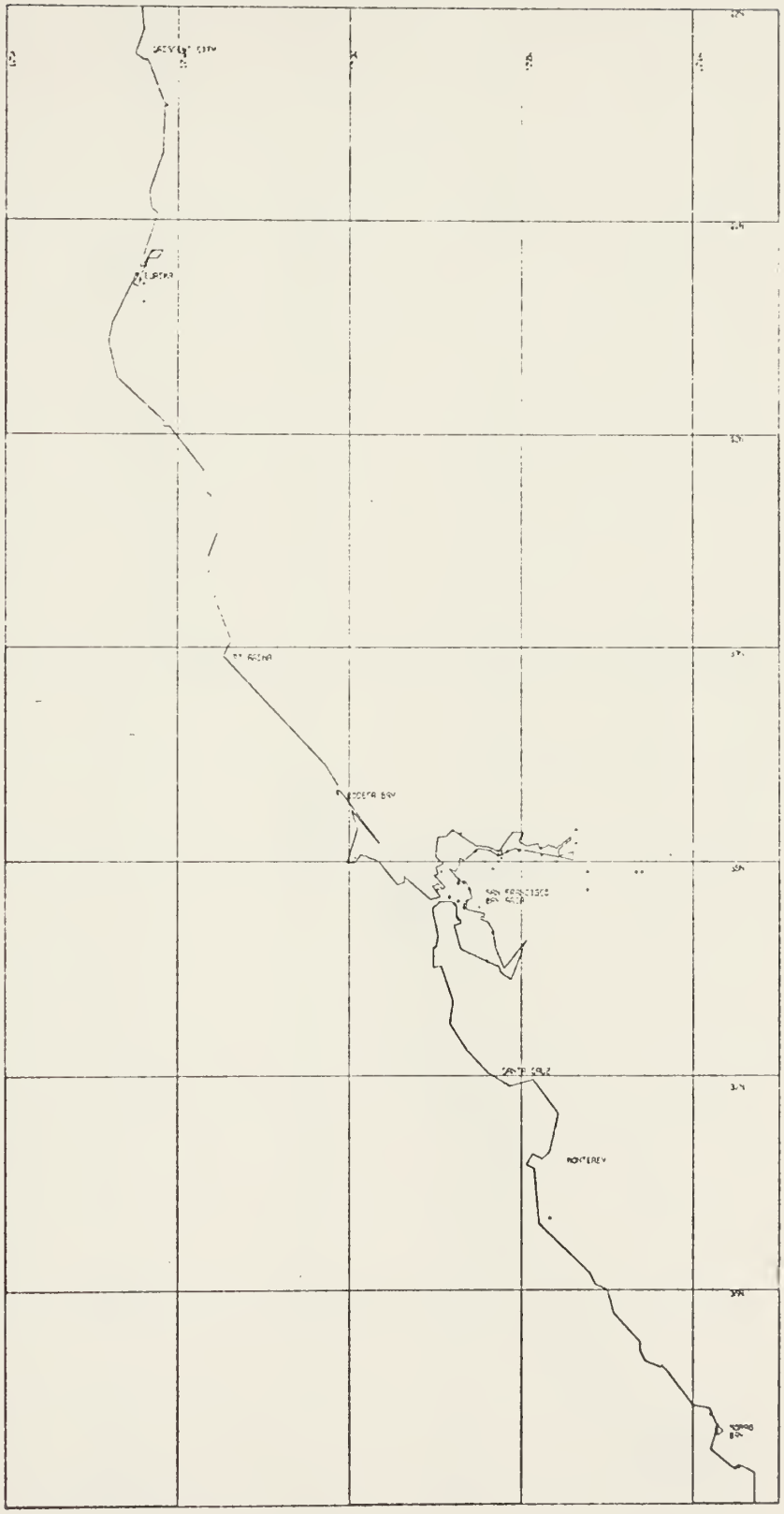


Figure 18

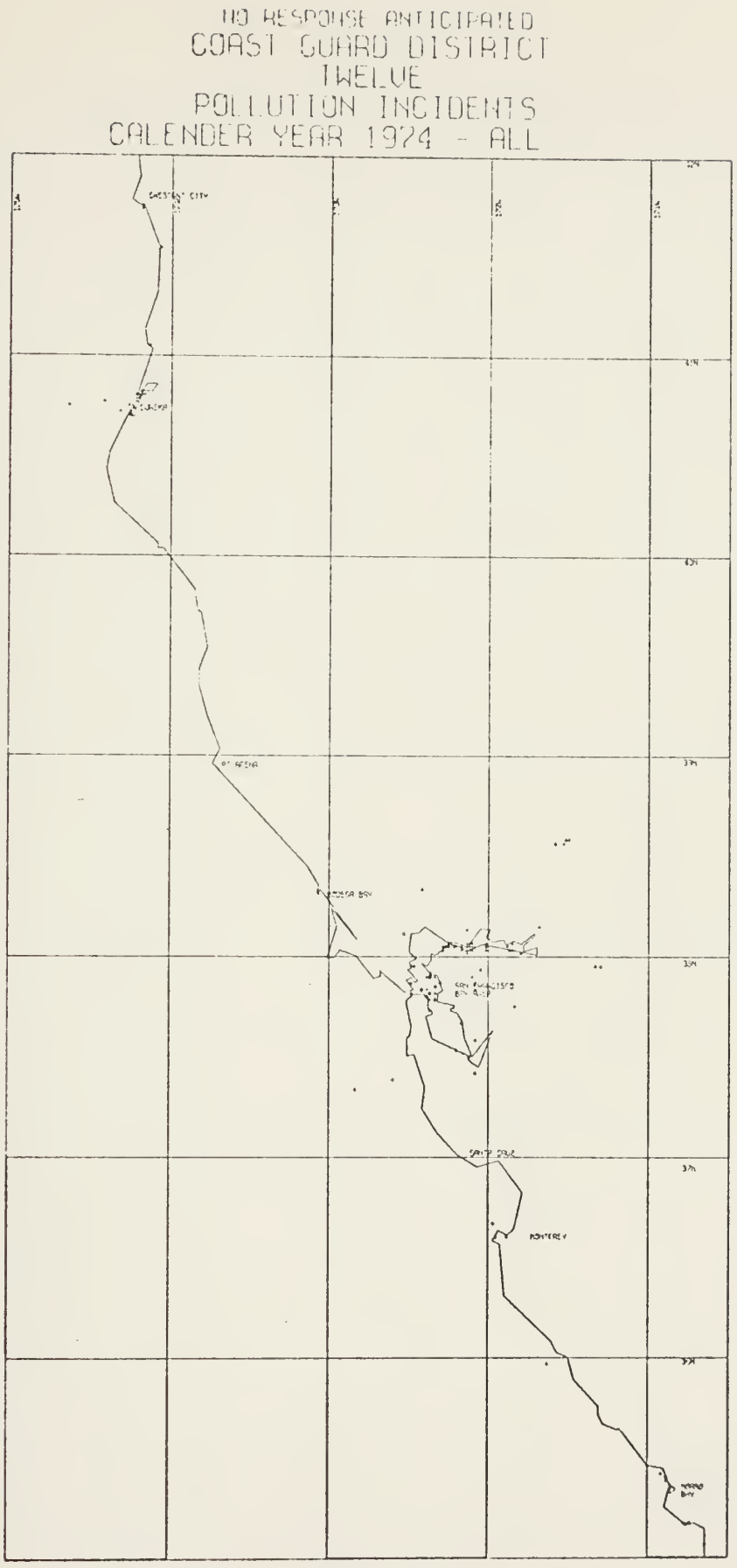

NO RESPONSE ANTICIPATED
COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1974 - ALL
MONTEREY

Figure 19

COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1974-GOVERNMENT

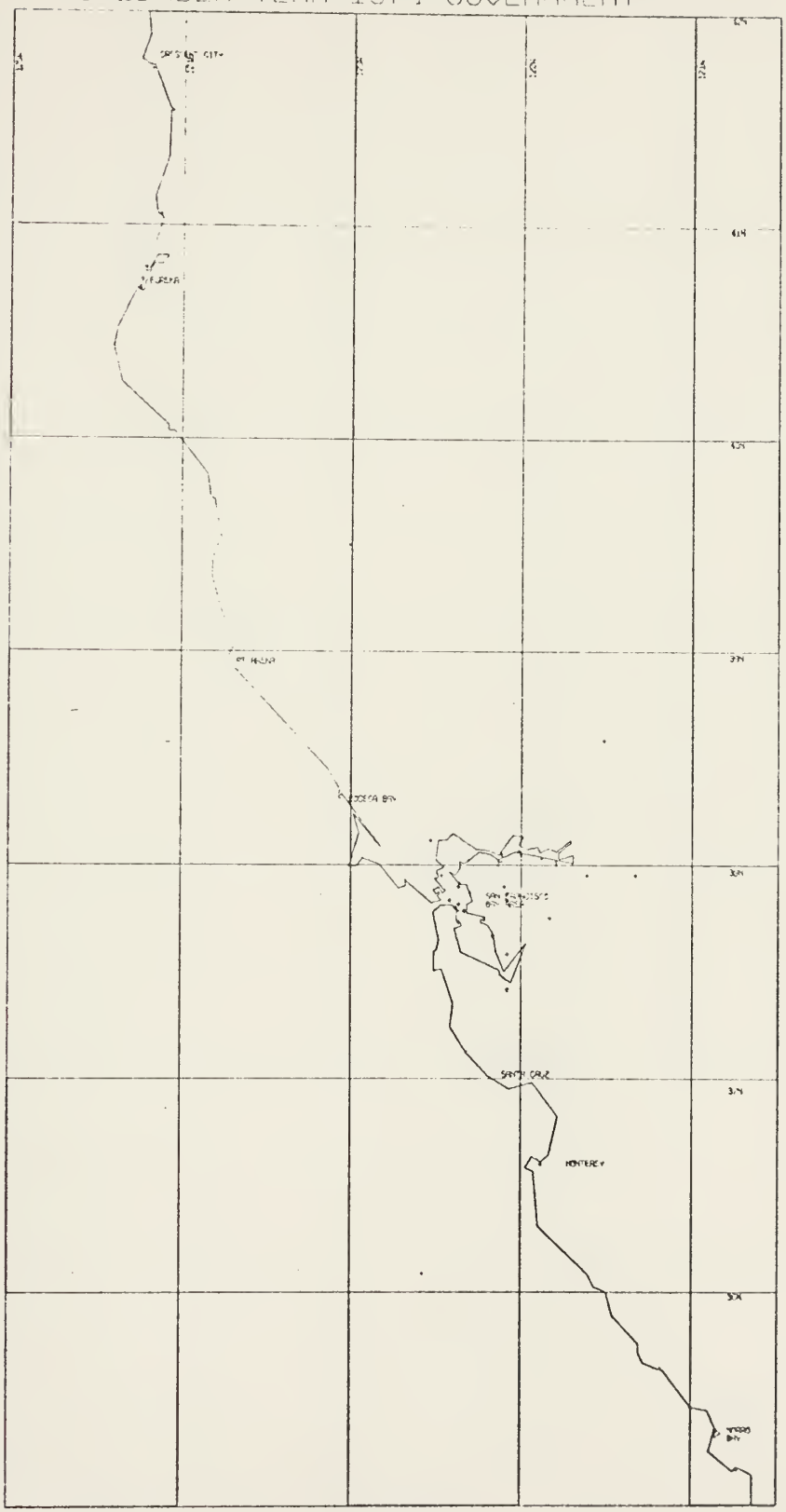


Figure 20

COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1974 - SPILLER

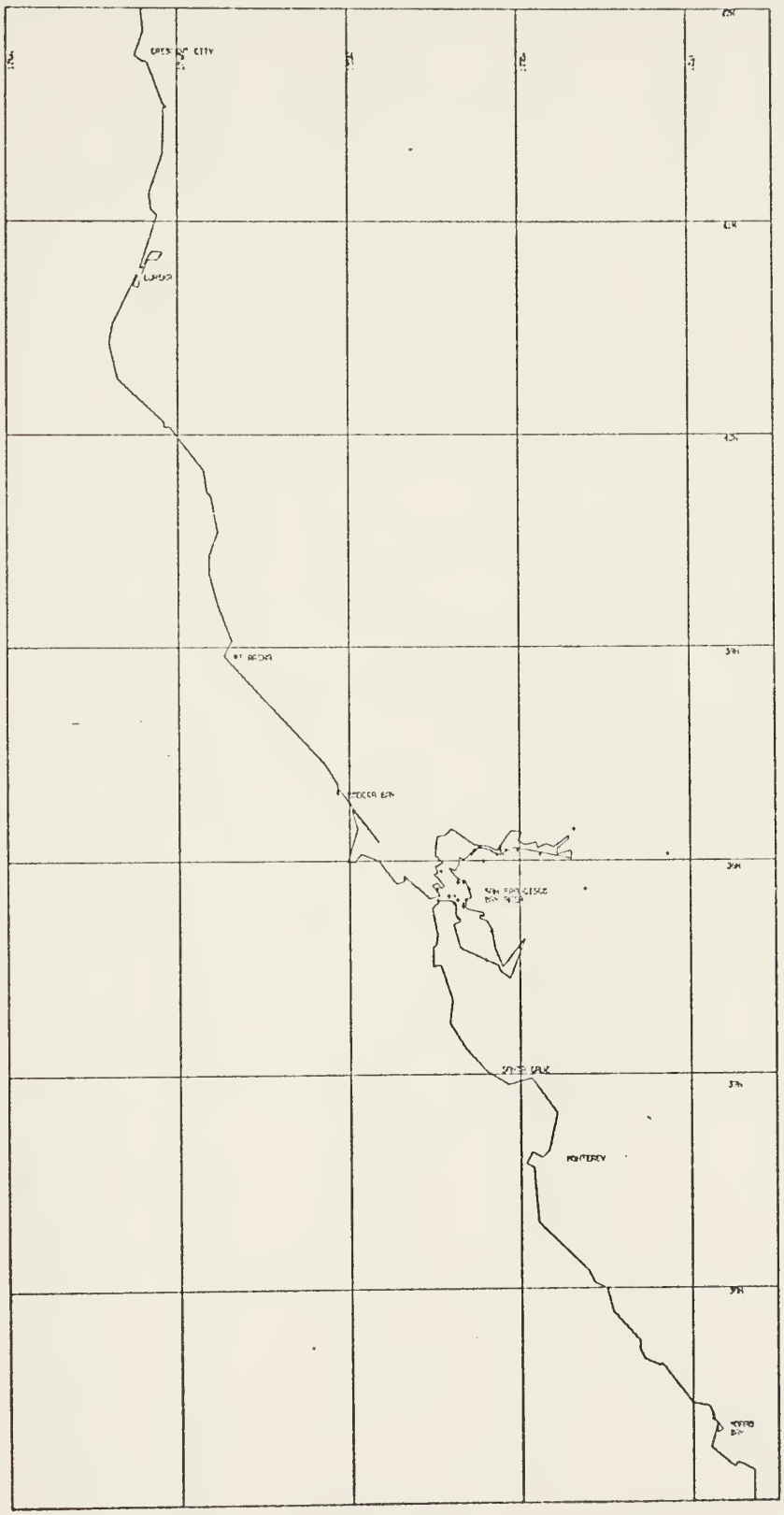


Figure 21

COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1974 -PRIVATE

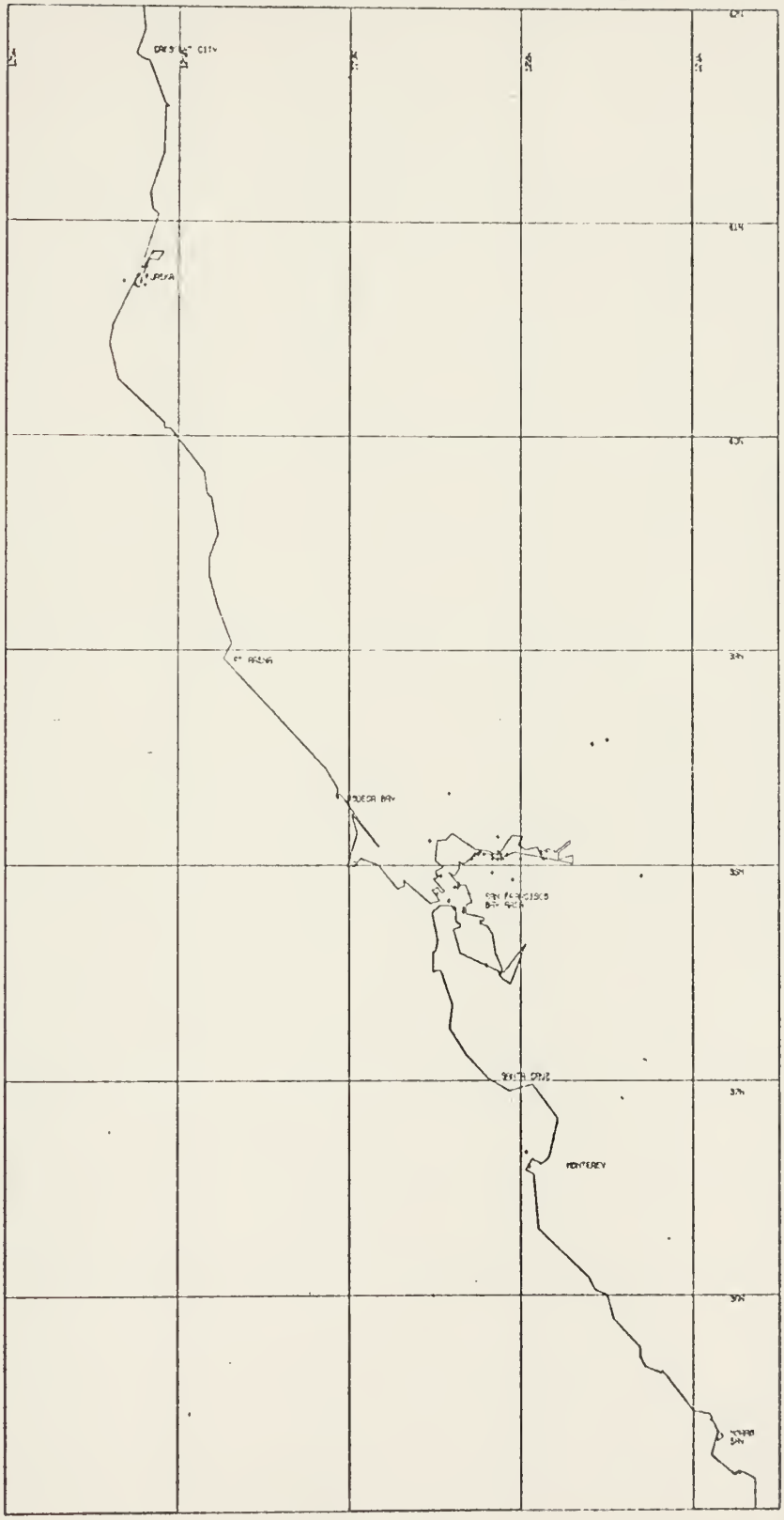


Figure 22

COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1974 -UNKNOWN

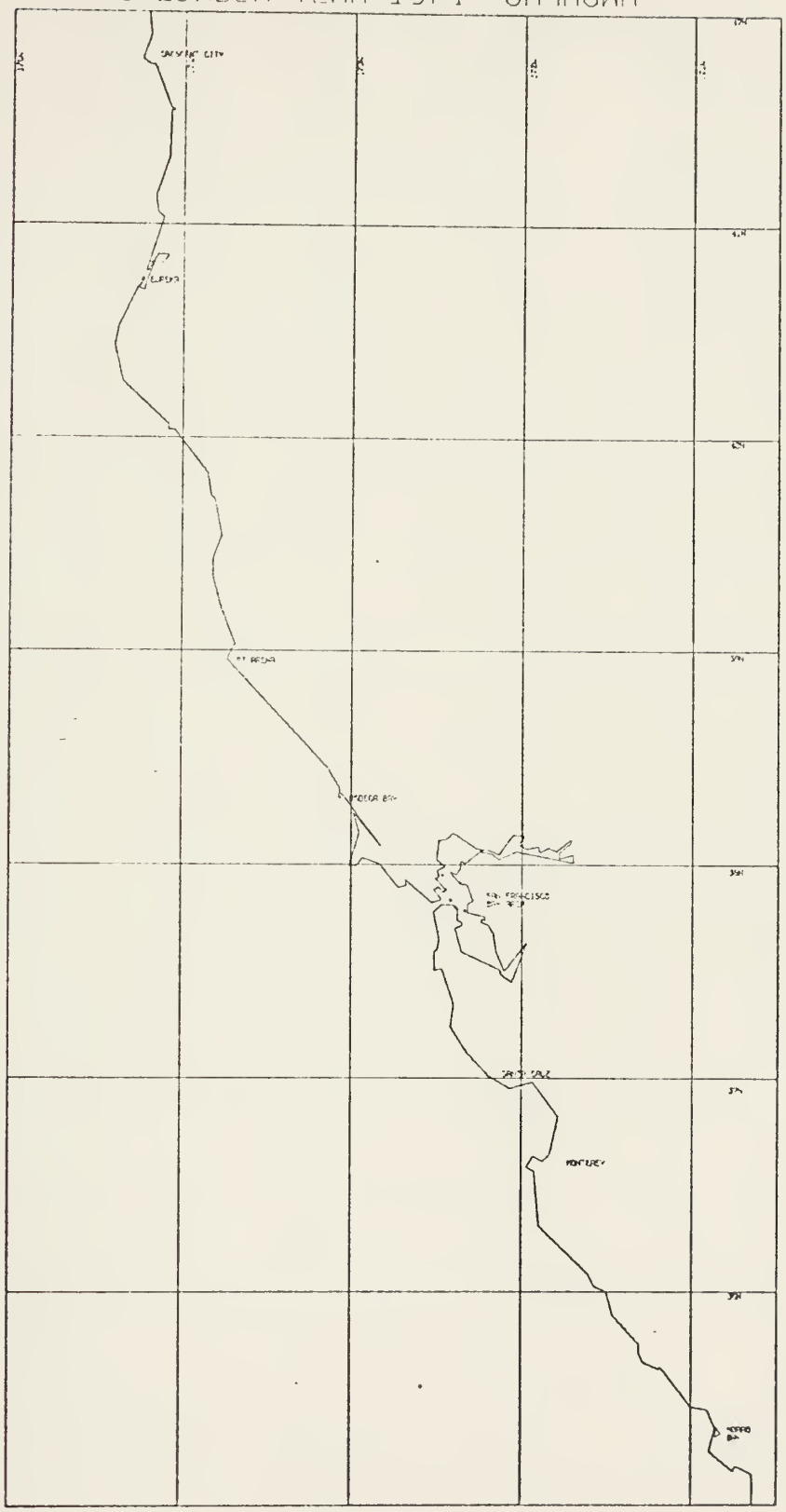


Figure 23

COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1974 - ALL CG

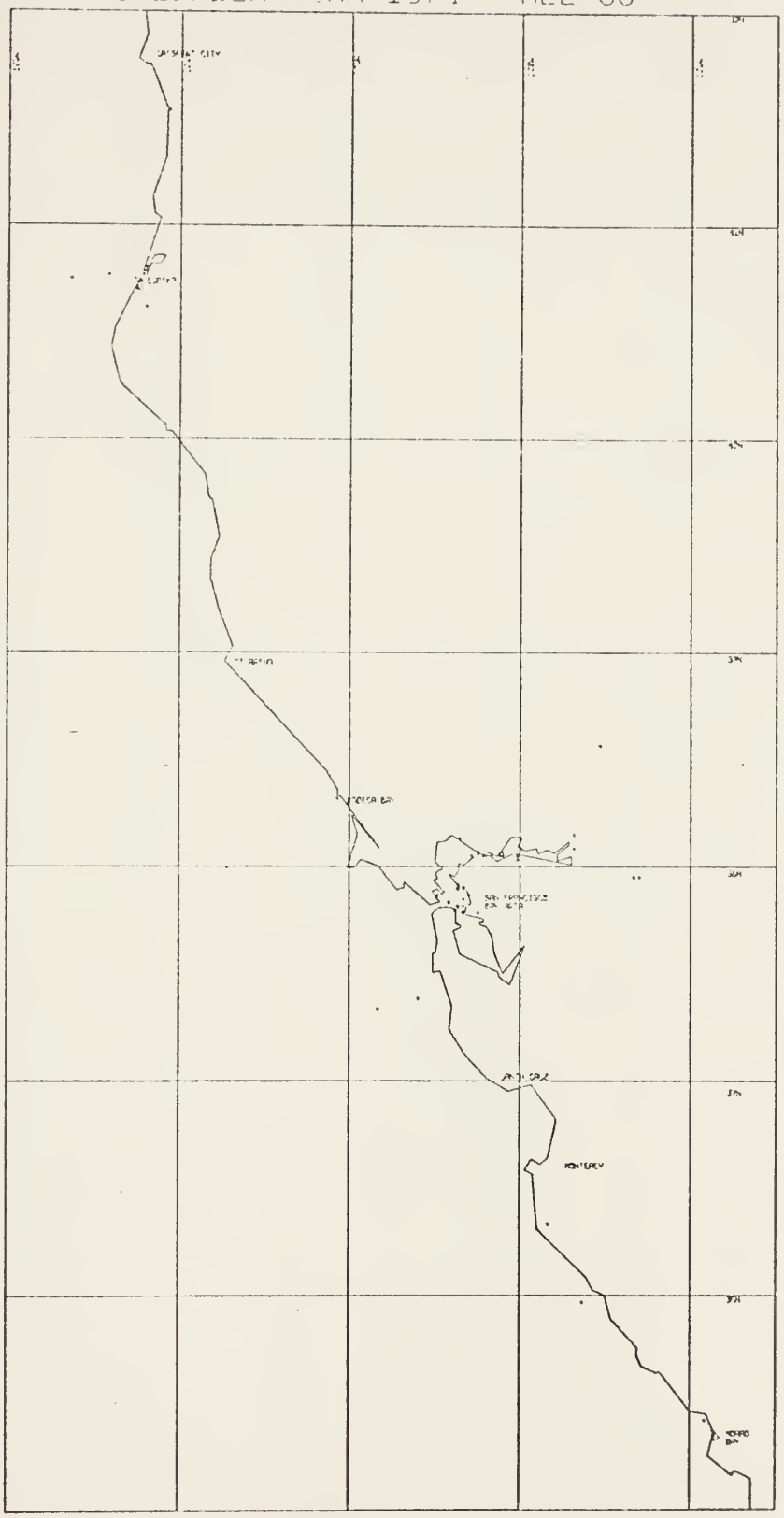


Figure 24

COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1974 - CG HELO

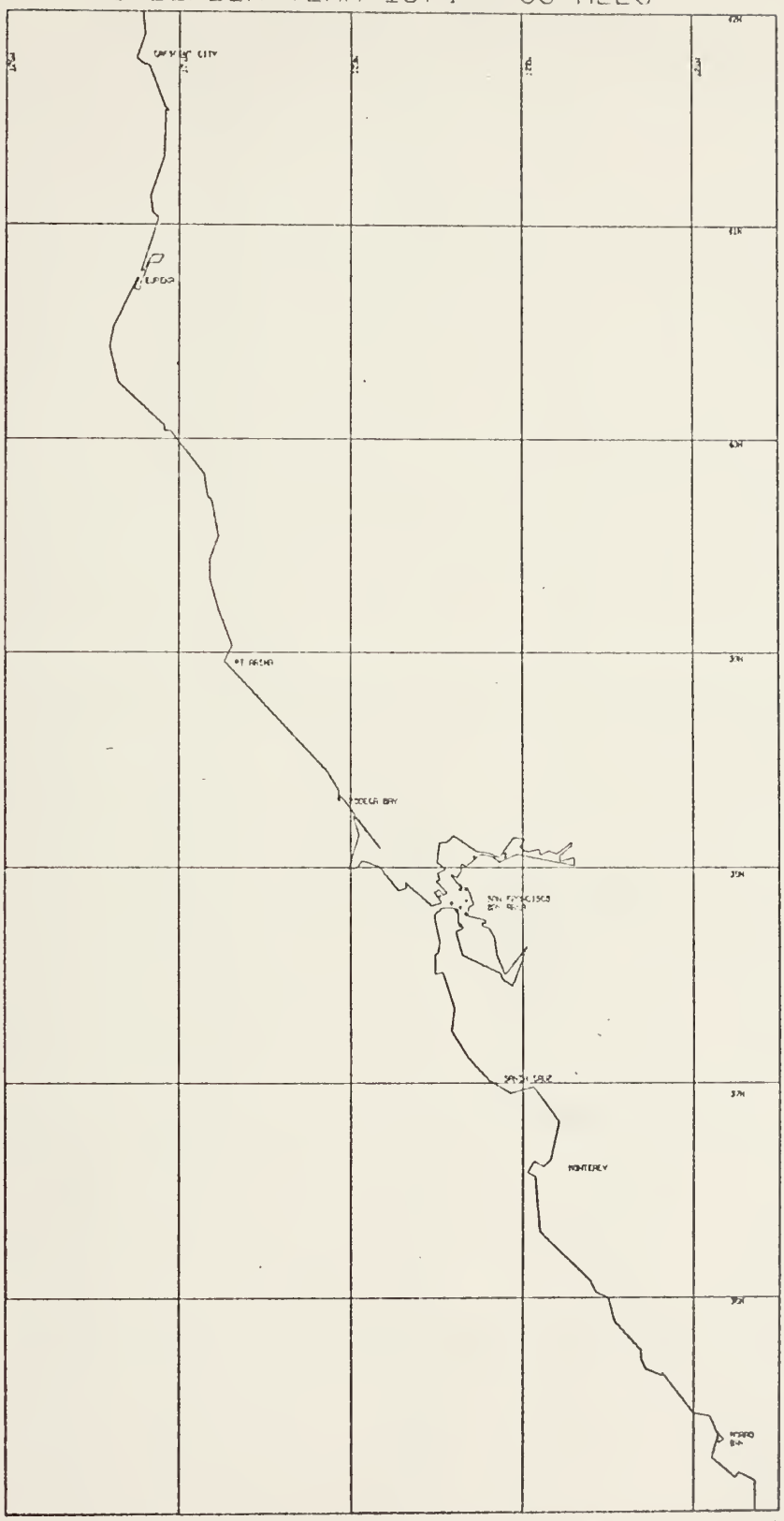


Figure 25

COAST GUARD DISTRICT
TWELVE
POLLUTION INCIDENTS
CALENDER YEAR 1974 - CG FW

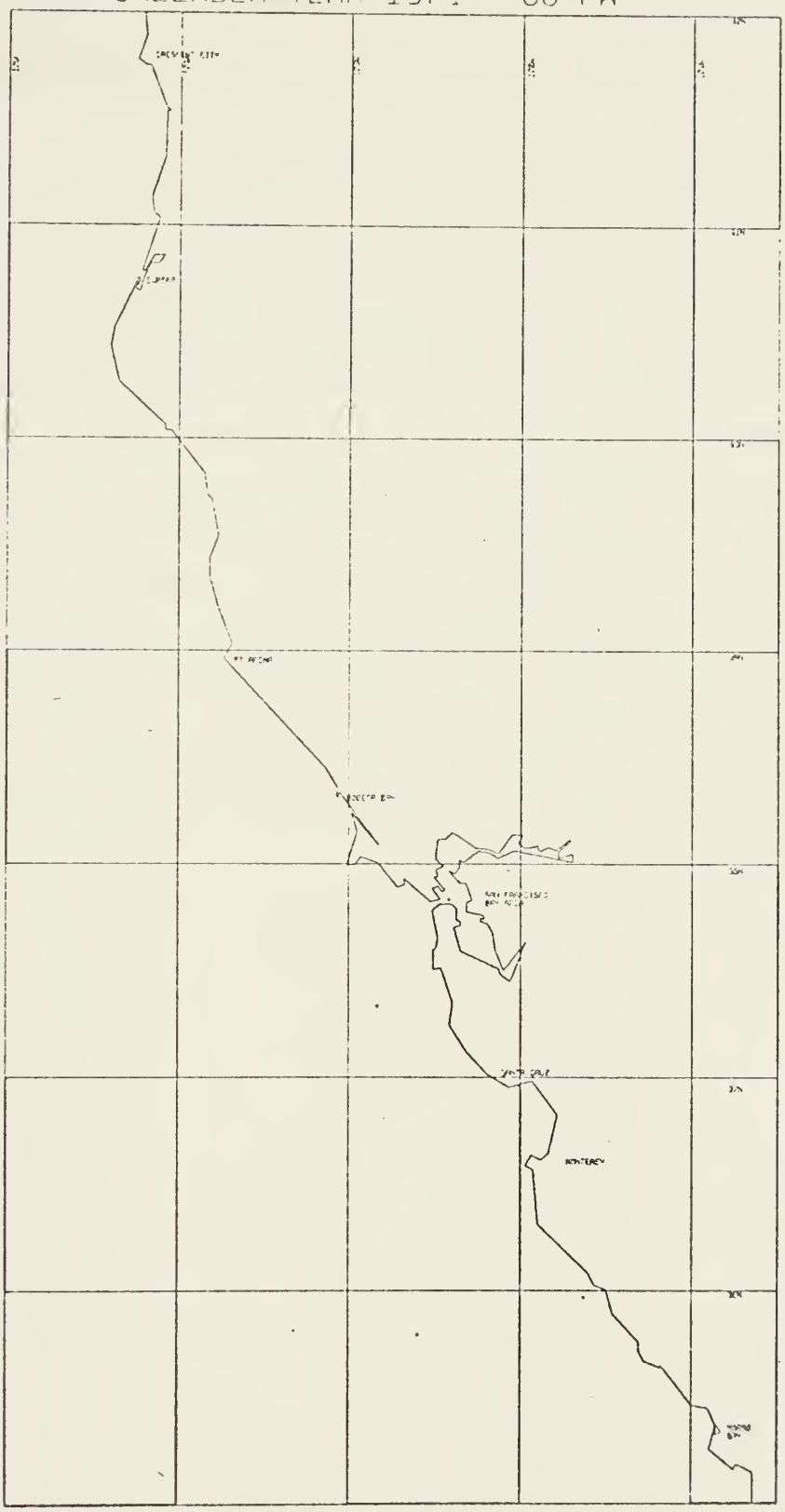


Figure 26

APPENDIX D

EXAMPLES OF SPSS OUTPUTS USING PIRS DATA

The following are examples of outputs using the subprograms FREQUENCIES and CROSSTABS from the Statistical Package for Social Sciences (SPSS reference). The data examined were magnetic tapes of the Pollution Incident Reporting System (PIRS) master file for the calendar years 1973 and 1974. FREQUENCIES gives a breakdown of the data field while CROSSTABS sets up a matrix of the two or more variables that are examined. SPSS has recently incorporated and sells the computer package to government computer centers at an initial cost of $1250.00. If desired, after the first year amendment and consultation service may be purchased for $600.00 a year.

SPSS Frequency Output From Nationwide 1973 PIRS Data
for Response Data Field

FILL PIRS (CREATION DATE = 10/01/75) DISCHARGE

RESPONSE

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
SOME RESPONSE	0.	3875	28.6	28.6	28.6
DISSIPATED	1.	7036	51.9	51.9	80.5
INACCESSIBLE	2.	1119	8.3	8.3	88.8
LOCATION	3.	302	2.2	2.2	91.0
SMALL SIZE	4.	847	6.2	6.2	97.2
POTENTIAL	5.	160	1.2	1.2	98.4
NON-REMOVABLE	6.	215	1.6	1.6	100.0
	TOTAL	13554	100.0	100.0	

Figure 27

SPSS Frequency Line Graph Output From Nationwide 1973 PIRS Data for Response Data Field

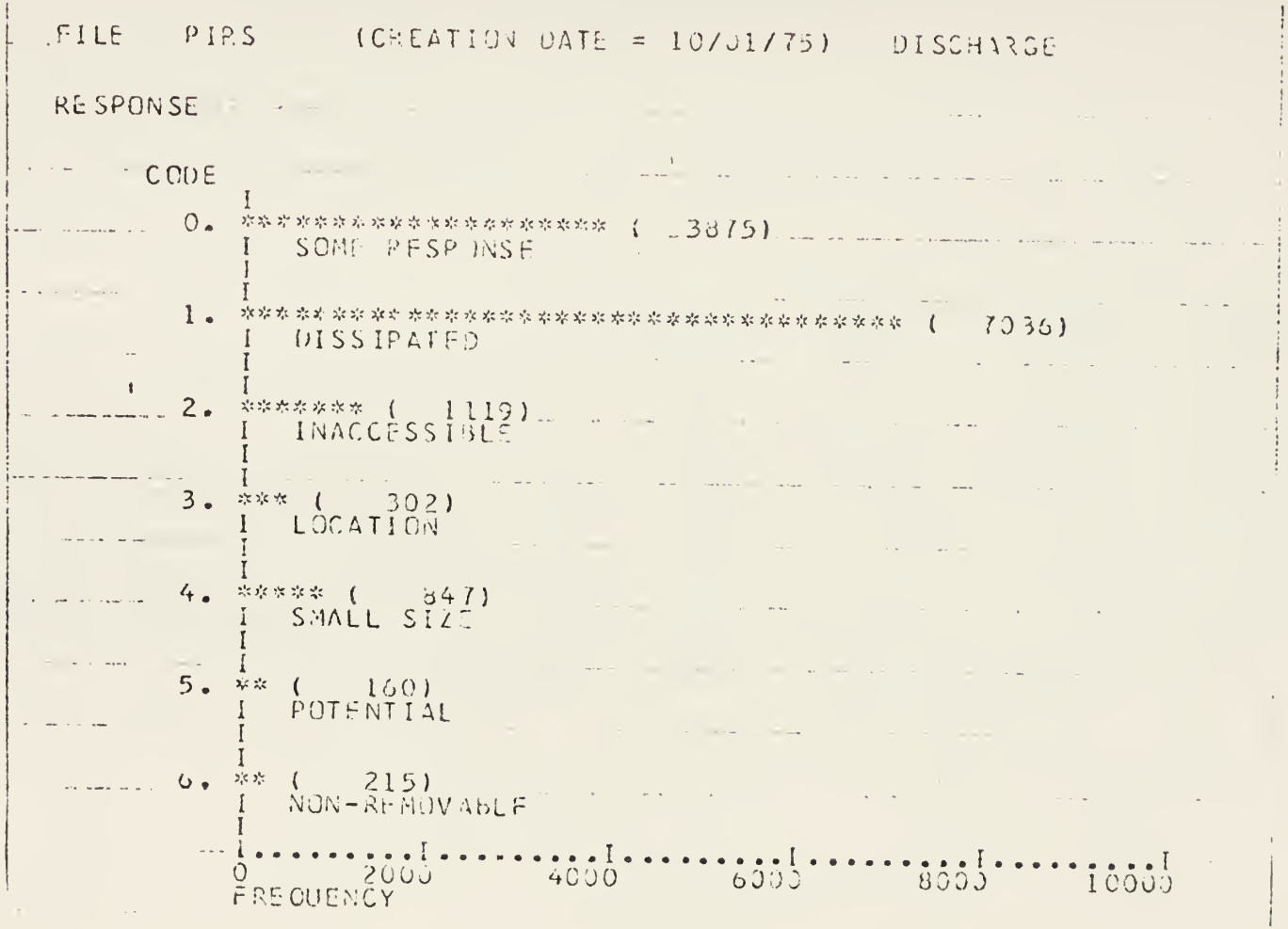


Figure 28

SPSS Frequency Output From 1973 Nationwide PIRS Data
for Quantity Data Field

FILE PIPS (CREATION DATE = 10/01/75) DISCHARGE

QUANTITY

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
10GAL LESS	1.	8544	63.0	63.0	63.0
11-100GAL	2.	3013	22.2	22.2	85.3
101-1000GAL	3.	1337	9.9	9.9	95.1
1001-10000GAL	4.	490	3.6	3.6	98.7
10001-100000GAL	5.	116	0.9	0.9	99.6
GREATER 100000GAL	6.	54	0.4	0.4	100.0
	TOTAL	13554	100.0	100.0	

Figure 29

SPSS Frequency Line Graph Output From 1973 Nationwide PIRS Data
for Quantity Data Field

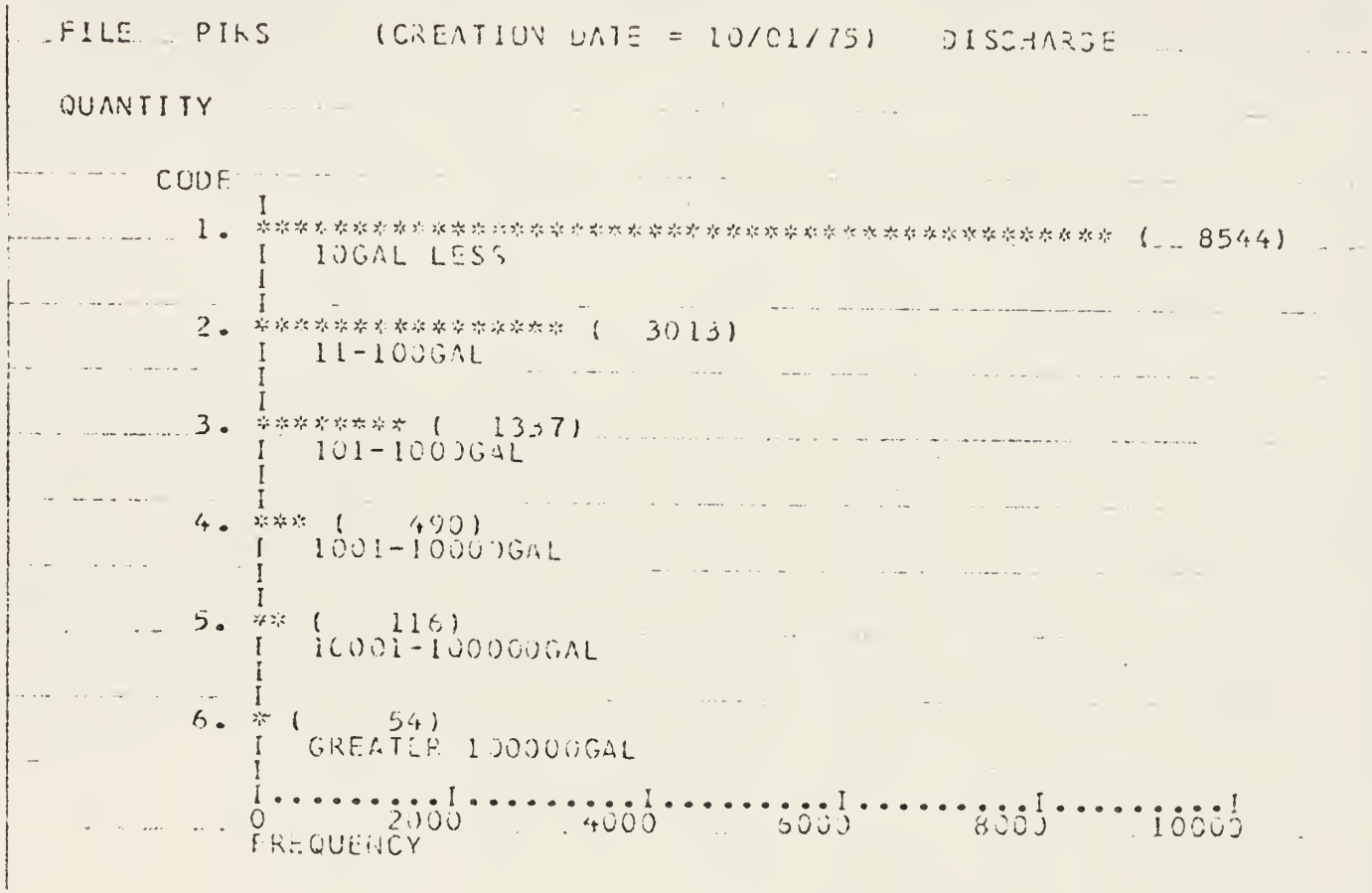


Figure 30

CROSSTABULATION OF NOTIFIER BY RESPONSE

NOTIFIER	COUNT / ROW PCT / COL PCT / TOT PCT	SOME RESPONSE 0.	DISSIPATED 1.	INACCESSIBLE 2.	LOCATION 3.	SMALL SIZE 4.	POTENTIAL 5.	NON-REMOVABLE 6.	ROW TOTAL
F CG SHORE UNIT		111	219	4	8	59	3	17	421
		26.4	52.0	1.0	1.9	14.0	0.7	4.0	3.1
		2.9	3.1	0.4	2.6	7.0	1.9	7.9	
		0.8	1.6	0.0	0.1	0.4	0.0	0.1	
E CG BOAT		45	170	0	8	31	3	9	266
		16.9	63.9	0.0	3.0	11.7	1.1	3.4	2.0
		1.2	2.4	0.0	2.6	3.7	1.9	4.2	
		0.3	1.3	0.0	0.1	0.2	0.0	0.1	
D CG SHIP		22	98	1	5	17	0	1	144
		15.3	68.1	0.7	3.5	11.8	0.0	0.7	1.1
		0.6	1.4	0.1	1.7	2.0	0.0	0.5	
		0.2	0.7	0.0	0.0	0.1	0.0	0.0	
C CG HELO		65	762	19	30	51	11	20	958
		6.8	79.5	2.0	3.1	5.3	1.1	2.1	7.1
		1.7	10.8	1.7	9.9	6.0	6.9	9.3	
		0.5	5.6	0.1	0.2	0.4	0.1	0.1	
B CG FIXED-WING AI		1	31	1	5	6	0	0	44
		2.3	70.5	2.3	11.4	13.6	0.0	0.0	0.3
		0.0	0.4	0.1	1.7	0.7	0.0	0.0	
		0.0	0.2	0.0	0.0	0.0	0.0	0.0	
A SPILLER		1636	1906	777	60	96	61	23	4559
		35.9	41.8	17.0	1.3	2.1	1.3	0.5	33.6
		42.2	27.1	69.4	19.9	11.3	38.1	10.7	
		12.1	14.1	5.7	0.4	0.7	0.5	0.2	
		82	2	0	0	0	1	0	85
		96.5	2.4	0.0	0.0	0.0	1.2	0.0	0.6
		2.1	0.0	0.0	0.0	0.0	0.6	0.0	
		0.6	0.0	0.0	0.0	0.0	0.0	0.0	
COLUMN TOTAL		3875	7036	1119	302	847	160	215	13554
		28.6	51.9	8.3	2.2	6.2	1.2	1.6	100.0

Figure 31

* * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * *
NOTIFIER BY QUANTITY
* *

NOTIFIER	COUNT / ROW PCT / COL PCT / TOT PCT	QUANTITY: 10GAL LESS 1.	11-100GAL 2.	101-1000 GAL 3.	1001-1000GAL 4.	10001-100000GAL 5.	GREATER 100000GA 6.	ROW TOTAL
F CG SHORE UNIT		290	88	27	11	4	1	421
		68.9	20.9	6.4	2.6	1.0	0.2	3.1
		3.4	2.9	2.0	2.2	3.4	1.9	
		2.1	0.6	0.2	0.1	0.0	0.0	
E CG BOAT		190	58	16	2	0	0	266
		71.4	21.8	6.0	0.8	0.0	0.0	2.0
		2.2	1.9	1.2	0.4	0.0	0.0	
		1.4	0.4	0.1	0.0	0.0	0.0	
D CG SHIP		110	24	8	1	1	0	144
		76.4	16.7	5.6	0.7	0.7	0.0	1.1
		1.3	0.8	0.6	0.2	0.9	0.0	
		0.8	0.2	0.1	0.0	0.0	0.0	
C CG HELO		843	94	13	4	3	1	958
		88.0	9.8	1.4	0.4	0.3	0.1	7.1
		9.9	3.1	1.0	0.8	2.6	1.9	
		6.2	0.7	0.1	0.0	0.0	0.0	
B CG FIXED-WING AI		34	8	0	2	0	0	44
		77.3	18.2	0.0	4.5	0.0	0.0	0.3
		0.4	0.3	0.0	0.4	0.0	0.0	
		0.3	0.1	0.0	0.0	0.0	0.0	
A SPILLER		2409	1263	593	204	61	29	4559
		52.8	27.7	13.0	4.5	1.3	0.6	33.6
		28.2	41.9	44.4	41.6	52.6	53.7	
		17.8	9.3	4.4	1.5	0.5	0.2	
		75	8	1	0	1	0	85
		88.2	9.4	1.2	0.0	1.2	0.0	0.6
		0.9	0.3	0.1	0.0	0.9	0.0	
		0.6	0.1	0.0	0.0	0.0	0.0	
	COLUMN TOTAL	8544	3013	1337	490	116	54	13554
		63.0	22.2	9.9	3.6	0.9	0.4	100.0

Figure 32

APPENDIX E

CARD FORMAT AND OUTPUT FOR AIRCRAFT FLIGHT RECORD

First, the card format for the "blue sheets" is listed and following it is an example of the computer output used in demonstrating what type of information could be obtained from the individual flight record. The program is written in FORTRAN and used data from Air Station San Francisco Aircraft Flight Records for the quarter ending 31 March 1974.

TABLE XIII

AIRCRAFT FLIGHT RECORD
DATA CARD FORMAT

Columns	Data Field
1-2	Year
3-4	Month
5-6	Day
8	Type Aircraft = 1 HH-52A 2 HU-16E 3 HC-130
10	Number of Pollution Detections
12-14	Total Resource Hours
17-19	SAR Resource Hours
21-23	MEP Resource Hours
27-29	Operational Training Resource Hours
31-33	ELT Resource Hours
37-39	Other Resource Hours
41-43	Total Employment Hours
47-49	SAR Employment Hours
51-52	Operational Training Employment Hours
57-59	MEP Employment Hours
61-62	ELT Employment Hours
67-69	Other Employment Hours

Computer Output from Air Station San Francisco
from Aircraft Flight Record for
Quarter Ending 31 March 1974 for the HH-52A Helicopter

```
TOTAL EMPLOYMENT HOURS CATEGORY 1        456.0
TOTAL RESOURSE HOURS CATEGORY 1        436.8
AVERAGE RESOURCE HOURSCATEGORY 1        1.6
AVERAGE EMPLOYMENT HOURS CATEGORY 1          1.7
AVERAGE RESOURCE HOURS WITH DETECTION 1          1.5
AVERAGE EMPLOYMENT HOURS WITH DETECTION 1            1.6
TOTAL EMPLOYMENT HOURS CATEGORY 2        161.1
TOTAL RESOURSE HOURS CATEGORY 2        156.0
AVERAGE RESOURCE HOURSCATEGORY 2        0.6
AVERAGE EMPLOYMENT HOURS CATEGORY 2          0.6
AVERAGE RESOURCE HOURS WITH DETECTION 2          0.6
AVERAGE EMPLOYMENT HOURS WITH DETECTION 2            0.1
TOTAL EMPLOYMENT HOURS CATEGORY 3        119.0
TOTAL RESOURSE HOURS CATEGORY 3        99.9
AVERAGE RESOURCE HOURSCATEGORY 3        0.4
AVERAGE EMPLOYMENT HOURS CATEGORY 3          0.4
AVERAGE RESOURCE HOURS WITH DETECTION 3          0.7
AVERAGE EMPLOYMENT HOURS WITH DETECTION 3            0.5
TOTAL EMPLOYMENT HOURS CATEGORY 4        109.0
TOTAL RESOURSE HOURS CATEGORY 4        115.2
AVERAGE RESOURCE HOURSCATEGORY 4        0.4
AVERAGE EMPLOYMENT HOURS CATEGORY 4          0.4
AVERAGE RESOURCE HOURS WITH DETECTION 4          0.4
AVERAGE EMPLOYMENT HOURS WITH DETECTION 4            0.7
TOTAL EMPLOYMENT HOURS CATEGORY 5          0.0
TOTAL RESOURSE HOURS CATEGORY 5        0.0
AVERAGE RESOURCE HOURSCATEGORY 5        0.0
AVERAGE EMPLOYMENT HOURS CATEGORY 5          0.0
AVERAGE RESOURCE HOURS WITH DETECTION 5          0.0
AVERAGE EMPLOYMENT HOURS WITH DETECTION 5            0.0
TOTAL EMPLOYMENT HOURS CATEGORY 6        66.9
TOTAL RESOURSE HOURS CATEGORY 6        65.7
AVERAGE RESOURCE HOURSCATEGORY 6        0.2
AVERAGE EMPLOYMENT HOURS CATEGORY 6          0.2
AVERAGE RESOURCE HOURS WITH DETECTION 6          0.3
AVERAGE EMPLOYMENT HOURS WITH DETECTION 6            0.3
RESOURCE HOURS DETECTIONS CREDITED 2        0.57
EMPLOYMENT HOURS DETECTIONS CREDITED 2          0.50
RESOURCE HOURS DETECTIONS CREDITED 3        6.12
EMPLOYMENT HOURS DETECTIONS CREDITED 3          1.64
RESOURCE HOURS DETECTIONS CREDITED 4        1.69
EMPLOYMENT HOURS DETECTIONS CREDITED 4          6.24
RESOURCE HOURS DETECTIONS CREDITED 5        0.0
EMPLOYMENT HOURS DETECTIONS CREDITED 5          0.0
RESOURCE HOURS DETECTIONS CREDITED 6        1.62
EMPLOYMENT HOURS DETECTIONS CREDITED 6          1.62
NUMBER OF DETECTIONS   10
NUMBER OF CARDS   271
MEP EMPLOYMENT HOURS SINGLE MISSION    93.2
```

Figure 33

APPENDIX F

TABLES OF POLLUTION INCIDENT CHARACTERISTICS FROM PIRS DATA

This appendix lists incident characteristics for two areas, nationwide and the Twelfth Coast Guard District. In each area three levels are examined: all incidents; all Coast Guard-detected incidents; and Coast Guard Aircraft-detected incidents. The tables are for the years 1973 and 1974 and used data from PIRS.

TABLE XIV

POLLUTION INCIDENT CHARACTERISTICS FOR ALL AND COAST GUARD DETECTED
NATIONWIDE PIRS DATA (%)

	All 1973	All 1974	Coast Guard Only 1973	Coast Guard Only 1974
Total Number of Incidents	13,554	14,454	2888	3141
I. Waterbody by Location				
Inland	1735(12.8)	2876(19.9)	310(10.7)	399(12.7)
Atlantic Coastal	3429(25.3)	3455(23.9)	1248(43.2)	1313(41.8)
Atlantic Offshore	95(0.7)	231(1.6)	51(1.8)	115(3.7)
Pacific Coastal	3023(22.3)	2660(18.4)	889(30.8)	793(25.2)
Pacific Offshore	217(1.6)	145(1.0)	75(2.6)	33(1.0)
Gulf Coastal	3009(22.2)	3209(22.2)	171(5.9)	320(10.2)
Gulf Offshore	1437(10.6)	1286(8.9)	3(0.1)	34(1.1)
Great Lakes	501(3.7)	448(3.1)	129(4.5)	129(4.1)
Unknown	108(.8)	144(1.0)	6(0.4)	8(0.2)
II. Source				
Vessel	3670(27.1)	3975(27.5)	858(29.7)	900(28.7)
Marine Facility	501(3.7)	622(4.3)	120(4.2)	145(4.6)
Land Vehicles	337(2.5)	434(3.0)	35(1.2)	53(1.7)
Land Transportation Facilities	163(1.2)	217(1.5)	49(1.7)	37(1.2)
Non-Transportation Land Facilities	1705(12.6)	1720(11.9)	456(15.8)	367(11.7)
Offshore Production Facility	1965(14.5)	2009(13.9)	15(0.5)	13(0.4)
Miscellaneous	350(2.6)	375(2.6)	96(3.3)	117(3.7)
Pipeline	583(4.3)	593(4.1)	24(6.8)	17(0.5)
Unknown	4280(31.6)	4509(31.2)	1235(42.8)	1492(47.5)

TABLE XIV (continued)

III. Cause				
Structural Failure or Loss	1491(11.0)	1749(12.1)	172(6.0)	298(9.5)
Equipment Failure	3267(24.1)	3975(27.5)	298(10.3)	235(7.5)
Personnel Error	2240(16.5)	2428(16.8)	465(16.1)	487(15.5)
Intentional Discharge	610(4.5)	665(4.6)	227(7.9)	247(7.9)
Natural Phenomenon	352(2.6)	390(2.7)	136(4.7)	121(3.8)
Unknown	5594(41.2)	5247(36.2)	1590(55.0)	1753(55.8)
IV. Material				
Petroleum Product	11,128(82.1)	11,737(81.2)	2223(77.0)	2473(78.7)
Liquid Chemical	258(1.9)	231(1.6)	40(1.4)	60(1.9)
Other & Miscellaneous	556(4.1)	491(3.4)	188(6.5)	147(4.7)
Unknown	1612(11.9)	1995(13.8)	437(15.1)	461(14.7)
V. Quantity				
10 gal or less	8539(63.0)	8990(62.2)	2211(76.6)	2479(78.5)
11 - 100 gal	3009(22.2)	3006(20.8)	475(16.4)	473(15.1)
101 - 1000 gal	1342(9.9)	1518(10.5)	145(5.0)	143(4.6)
1001 - 10,000 gal	488(3.6)	694(4.8)	43(1.5)	36(1.1)
10,001 - 100,000 gal	122(0.9)	188(1.3)	11(0.4)	7(0.2)
Greater- 100,000 gal	54(0.4)	58(0.4)	3(0.1)	3(0.1)
VI. Response				
Some response anticipated	3875(28.6)	5241(36.3)	554(19.2)	577(18.4)
No response because:				
Dissipated by Weather	7036(51.9)	7421(51.3)	1864(64.5)	2044(65.1)
Inaccessible	1119(8.3)	61(0.4)	33(1.1)	16(0.5)
Location	302(2.2)	211(1.5)	68(2.4)	65(2.1)
Small Size	847(6.2)	695(4.8)	280)9.7)	258(8.2)
Potential Only	160(1.2)	409(2.8)	26(0.9)	54(1.7)
Non-Removable	215(1.6)	415(2.9)	63(2.2)	127(4.0)

TABLE XV

POLLUTION INCIDENT CHARACTERISTICS FOR COAST GUARD AIRCRAFT
NATIONWIDE PIRS DATA (%)

		1973 CG Helo	1973 CG Fixed Wing	1974 CG Helo	1974 CG Fixed Wing
I.	Number of Incidents in This Category	958	44	1004	82
II.	Location by Water Body				
	Inland	50(5.2)	2(4.5)	41(4.1)	1(1.2)
	Atlantic Coastal	498(52.0)	19(43.2)	526(52.4)	22(26.8)
	Atlantic Offshore	35(3.7)	5(11.4)	51(5.1)	24(29.3)
	Pacific Coastal	239(25.0)	2(4.5)	265(26.4)	2(2.4)
	Pacific Offshore	56(5.8)	6(13.6)	13(1.3)	5(6.1)
	Gulf Coastal	52(5.4)	3(6.8)	75(7.5)	4(4.9)
	Gulf Offshore	2(0.2)	1(2.3)	9(0.9)	13(15.6)
	Great Lakes Area	24(2.5)	6(13.6)	23(2.3)	11(13.4)
	Unknown	2(0.2)	-	1(0.1)	-
III.	Source				
	Vessel	187(19.6)	17(38.6)	166(16.5)	34(41.4)
	Marine Facility	28(2.9)	3(6.8)	28(2.8)	1(1.2)
	Land Vehicle	1(0.1)	-	3(0.3)	-
	Land Transportation Facility	5(0.5)	-	4(0.4)	-
	Miscellaneous	49(5.1)	1(2.3)	32(3.2)	4(4.9)
	Pipe Line	3(.3)	-	3(0.3)	1(1.2)
	Non Transportation Facility	118(12.3)	7(15.9)	92(9.2)	8(9.8)
	Unknown	567(59.2)	16(36.4)	676(67.3)	34(41.5)

TABLE XV (continued)

IV.	Cause			
	Structural Failure	21(2.2)	1(2.3)	43(4.3)	3(3.7)
	Equipment Failure	67(7.0)	4(9.1)	33(3.3)	4(4.9)
	Personnel Error	56(5.8)	2(4.5)	55(5.5)	5(6.1)
	Intentional Discharge	62(6.5)	3(6.8)	68(6.8)	13(15.6)
	Natural Phenomenon	63(6.6)	2(4.5)	35(3.5)	4(4.9)
	Unknown	689(71.9)	32(72.7)	770(76.7)	53(64.6)
V.	Material				
	Petroleum Product	686(71.6)	27(61.4)	744(74.1)	60(73.2)
	Liquid Chemical	8(0.8)	-	22(2.2)	-
	Other & Miscellaneous	49(5.1)	-	50(5.0)	5(6.1)
	Unknown	215(22.5)	17(38.6)	188(18.7)	17(20.7)
VI.	Quantity				
	10 gal or less	843(88.0)	34(77.3)	883(87.9)	69(84.1)
	11 - 100 gal	94(9.4)	8(18.2)	89(8.9)	11(13.4)
	101 - 1000 gal	13(1.4)	--	22(2.2)	2(2.4)
	1001 - 10,000 gal	4(0.4)	2(4.5)	9(0.9)	--
	10,001 - 100,000 gal	3(0.3)	--	1(0.1)	--
	Greater 100,000 gal	1(0.1)	--	--	--
VII.	Response				
	Some Response Anticipated	65(6.8)	1(2.3)	58(5.8)	6(7.3)
	No Response Because:				
	Dissipated by Weather	762(79.5)	31(70.5)	801(79.8)	57(69.5)
	Inaccessible	19(2.0)	1(2.3)	5(0.5)	1(1.2)
	Location	30(3.1)	5(11.4)	26(2.6)	7(8.5)
	Small Size	51(5.3)	6(13.6)	63(6.3)	7(8.5)
	Potential Only	11(1.1)	--	11(1.1)	1(1.2)
	Non-Removable	20(2.1)	--	40(4.0)	3(3.7)

TABLE XVI

POLLUTION INCIDENT CHARACTERISTICS FOR ALL AND COAST GUARD DETECTED
TWELFTH COAST GUARD DISTRICT PIRS DATA (%)

		1973 12th CG District All	1974 12th CG District All	1973 All CG Within 12th CG District	1974 All CG Within 12th CG District
I.	Number of Incidents in This Category	660	600	188	146
II.	Location by Water Body				
	Inland	34(5.2)	73(12.1)	5(2.7)	19(13.0)
	Pacific Coastal	601(91.1)	499(83.2)	176(93.6)	117(80.1)
	Offshore				
	Territorial Sea	9(1.4)	7(1.2)	1(0.5)	2(1.4)
	Contiguous Zone	4(0.6)	3(0.5)	3(1.6)	2(1.4)
	Prohibited Zone	1(0.1)	3(0.5)	1(0.5)	2(1.4)
	Greater 50 Miles Offshore	1(0.1)	-	-	-
	Unknown	10(1.5)	15(2.5)	2(1.1)	4(2.7)
III.	Source				
	Vessel	235(35.6)	186(31.0)	59(31.4)	35(24.0)
	Marine Facility	22(3.3)	40(6.7)	8(4.3)	7(4.8)
	Land Vehicles	27(4.1)	30(5.0)	3(1.6)	2(1.4)
	Land Transportation Facility	21(3.2)	17(2.8)	7(3.7)	2(1.4)
	Miscellaneous	29(4.4)	29(4.8)	8(4.3)	10(6.8)
	Pipeline	5(0.8)	7(1.2)	3(1.6)	-
	Unknown	237(35.9)	250(41.7)	65(34.5)	80(54.8)
	Non Transportation Land Facility	84(12.7)	41(6.8)	35(18.6)	10(6.8)

TABLE XVI (continued)

IV. Cause				
Structural Failure	54(8.2)	59(9.8)	11(5.9)	13(8.9)
Equipment Failure	72(10.9)	77(12.8)	18(9.6)	9(6.2)
Personnel Error	133(20.2)	129(21.5)	38(20.2)	23(15.7)
Intentional Discharge	50(7.6)	28(4.7)	19(10.1)	6(4.1)
Natural Phenomenon	22(3.3)	12(2.0)	9(4.8)	3(2.1)
Unknown	329(49.8)	295(49.2)	93(49.4)	92(63.0)
V. Material				
Petroleum Product	503(76.2)	397(66.2)	135(71.9)	86(58.9)
Liquid Chemical	17(2.6)	12(2.0)	4(2.1)	2(1.4)
Other & Miscellaneous	50(7.6)	39(6.5)	23(12.2)	8(5.5)
Unknown	90(13.6)	152(25.3)	26(13.8)	50(34.2)
VI. Quantity				
10 gal or less	471(71.4)	384(64.0)	145(77.1)	109(74.6)
11 - 100 gal	116(17.6)	133(22.2)	33(17.6)	20(13.7)
101 - 1000 gal	53(8.0)	66(11.0)	4(2.1)	14(9.6)
1001 - 10,000 gal	16(2.4)	14(2.3)	5(2.7)	2(1.4)
10,001 - 100,000 gal	1(0.1)	3(0.5)	-	1(0.7)
Greater 100,000 gal	3(0.4)	-	1(0.5)	-
VII. Response				
Some Response Anticipated	170(25.8)	166(27.7)	32(17.0)	19(13.0)
No Response Because:				
Dissipated by Weather	355(53.8)	333(55.5)	110(58.5)	105(71.9)
Inaccessible	6(0.9)	3(0.5)	1(0.5)	1(0.7)
Location	11(1.6)	20(3.3)	2(1.1)	3(2.1)
Small Size	108(16.4)	68(11.3)	40(21.3)	14(9.5)
Potential Only	8(1.2)	4(0.7)	1(0.5)	3(2.1)
Non-Removable	2(0.3)	6(1.0)	2(1.1)	1(0.7)

TABLE XVII

POLLUTION INCIDENT CHARACTERISTICS FOR COAST GUARD AIRCRAFT DETECTED INCIDENTS
TWELFTH COAST GUARD DISTRICT PIRS DATA (%)

		1973 CG Helo	1973 CG Fixed Wing	1974 CG Helo	1974 CG Fixed Wing
I.	Number of Incidents in This Category	52	3	41	5
II.	Location by Water Body				
	Inland	-	-	2(4.9)	-
	Pacific Coastal	51(98.1)	-	38(92.7)	1(20.0)
	Off Shore:				
	Territorial Sea	-	-	-	1(20.0)
	Contiguous Zone	-	2(66.7)	-	1(20.0)
	Prohibited Zone	-	1(33.3)	-	2(40.0)
	Greater 50 Miles Offshore	-	-	-	-
	Unknown	1(1.7)	-	1(2.4)	-
III.	Source				
	Vessel	11(21.2)	3(100.0)	-	3(60.0)
	Marine Facility	-	-	2(4.9)	-
	Land Vehicles	-	-	-	-
	Land Transportation Facility	-	-	-	-
	Pipeline	-	-	-	-
	Non Transportation Facility	2(3.8)	-	2(4.9)	-
	Miscellaneous	2(3.8)	-	1(2.4)	-
	Unknown	37(71.2)	-	36(87.8)	2(40.0)

TABLE XVII (continued)

IV.	Cause				
	Structural Failure	-	1(33.3)	-	-
	Equipment Failure	2(3.8)	-	2(4.9)	-
	Personnel Error	1(1.9)	-	1(2.4)	-
	Intentional Discharge	2(3.8)	-	-	-
	Natural Phenomenon	3(5.8)	-	1(2.4)	-
	Unknown	44(84.6)	2(67.7)	36(87.8)	5(100.0)
V.	Material				
	Petroleum Product	35(67.3)	1(33.3)	15(36.6)	2(40.0)
	Liquid Chemical	-	-	-	-
	Other & Miscellaneous	3(5.8)	-	3(7.3)	-
	Unknown	14(26.9)	2(67.7)	23(56.1	3(60.0)
VI.	Quantity				
	10 gal or less	49(94.2)	1(33.3)	37(90.2)	4(80.0)
	11 - 100 gal	2(3.8)	1(33.3)	3(7.3)	1(20.0)
	101 - 1000 gal	-	-	1(2.4)	-
	1001 - 10,000 gal	-	1(33.3)	-	-
	10,001 - 100,000 gal	-	-	-	-
	Greater 100,000 gal	1(1.9)	-	-	-
VII.	Response				
	Some Response Anticipated	4(7.7)	-	1(2.4)	-
	No Response Because:				
	Dissipated by Weather	34(65.4)	3(100.0)	38(92.7)	3(60.0)
	Inaccessible	-	-	-	1(20.0)
	Location	-	-	-	-
	Small Size	14(26.9)	-	2(4.9)	1(20.0)
	Potential Only	-	-	-	-
	Non-Removable	-	-	-	-

APPENDIX G

COBOL RECORD FORMATS FOR PROPOSED AIRCRAFT POLLUTION REPORTING SYSTEM

This appendix lists suggested record formats in COBOL language for the proposed aircraft reporting system discussed in Chapter V. There are three records: individual, mission and MEP.

TABLE XVIII

PROPOSED INDIVIDUAL RECORD COBOL FOR MAT

01	Individual		
	02	Record-Number-Indiv	
		03 Air-Station-ID-Indiv	PIC 99
		03 Indiv-Record-Number	PIC 9(5)
	02	Aircraft-Type	PIC 9
	02	Aircraft-Number	PIC 9(4)
	02	Julian-Date	PIC 9(3)
	02	Total-Flight-Time	PIC 99V9
	02	Departure-Point	PIC X(3)
	02	Arrival-Point	PIC X(3)
	02	First-Pilot-Time	PIC 99V9
	02	Copilot-Time	PIC 99V9
	02	Special Crew-Time	PIC 99V9
	02	Training	
		03 Syllabus-Type	PIC X(2)
		03 Syb-Completion-Code	PIC A
		03 Maneuver-Type-One	PIC X
		03 Maneuver-Number-One	PIC 9
		03 Maneuver-Type-Two	PIC X
		03 Maneuver- Number-Two	PIC 9
		03 Maneuver-Type-Three	PIC X
		03 Maneuver-Number-Three	PIC 9

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02  Night-Time                          PIC 99V9
02  Landings
    03  Land-Type-One                   PIC X
    03  Land-Number-One                 PIC 99
    03  Land-Type-Two                   PIC X
    03  Land-Number-Two                 PIC 9
    03  Land-Type-Three                 PIC X
    03  Land-Number-Three               PIC 9
02  Instrument-Time
    03  Actual-Time                     PIC 99V9
    03  Simulated-Time                  PIC 99V9
02  Approaches
    03  First-One
        04  Type-One                    PIC A
        04  Act-or-Sim-One              PIC A
        04  Number-One                  PIC 9
    03  Second-Two
        04  Type-Two                    PIC A
        04  Act-or-Sim-Two              PIC A
        04  Number-Two                  PIC 9
    03  Third-Three
        04  Type-Three                  PIC A
        04  Act-or-Sim-Three            PIC A
        04  Number-Three                PIC 9
```

02	Mark-If-Last-Indiv	PIC 9
02	Number-of-Indiv	PIC 9
02	Indiv-Code	PIC A

TABLE XIX

PROPOSED MISSION RECORD COBOL FORMAT

01		Mission	
	02	Record-Number-MIS	
		03 Air-Station-ID-MIS	PIC 99
		03 Mis-Record-Number	PIC 9(5)
	02	Flight-Code	PIC 99
	02	Start-Time-MIS	PIC 9(4)
	02	Stop-Time-MIS	PIC 9(4)
	02	Resource-Hrs-MIS	PIC 99V9
	02	Employment-Hrs-MIS	PIC 99V9
	02	Mark-IF-Last-MIS	PIC 9
	02	Number-Of-Mission	PIC 9
	02	Mission-Code	PIC A

TABLE XX

PROPOSED MEP RECORD COBOL FORMAT

01	MEP		
	02	Record-Number-MEP	
		03 Air-Station-ID-MEP	PIC 99
		03 MEP-Record-Number	PIC 9(5)
	02	Sensor	
	02	Area-Code	
		03 Specific-Area	PIC 99
		03 Water-Body	PIC 9(3)
	02	Start-Time-MEP	PIC 9(4)
	02	Stop-Time-MEP	PIC 9(4)
	02	Resource-Hrs-MEP	PIC 99V9
	02	Employment-Hrs-MEP	PIC 99V9
	02	Detections	
		03 Type-Detec	PIC X
		03 How-Detec	PIC X
		03 PIRS-ID	
		04 District-ID	PIC 99
		04 IND-District-ID	PIC 9(5)
	02	Mark-IF-Last-MEP	PIC 9
	02	Number-Of-MEP	PIC 9
	02	MEP-Code	PIC A

APPENDIX H

BREAKDOWN OF THE POLLUTION INCIDENT REPORTING SYSTEM RECORD

The PIRS record is 424 characters long with approximately 68 data fields. The coding for these data fields are listed in CG450 [Reference 14]. There are three main areas in the record: discharge, data on the spill itself; response, data on the cleanup efforts of the spill; and penalty action data on legal actions involved with the spill.

This appendix identifies in detail the 424 characters of the PIRS record.

PIRS Record Characters 1 thru 80

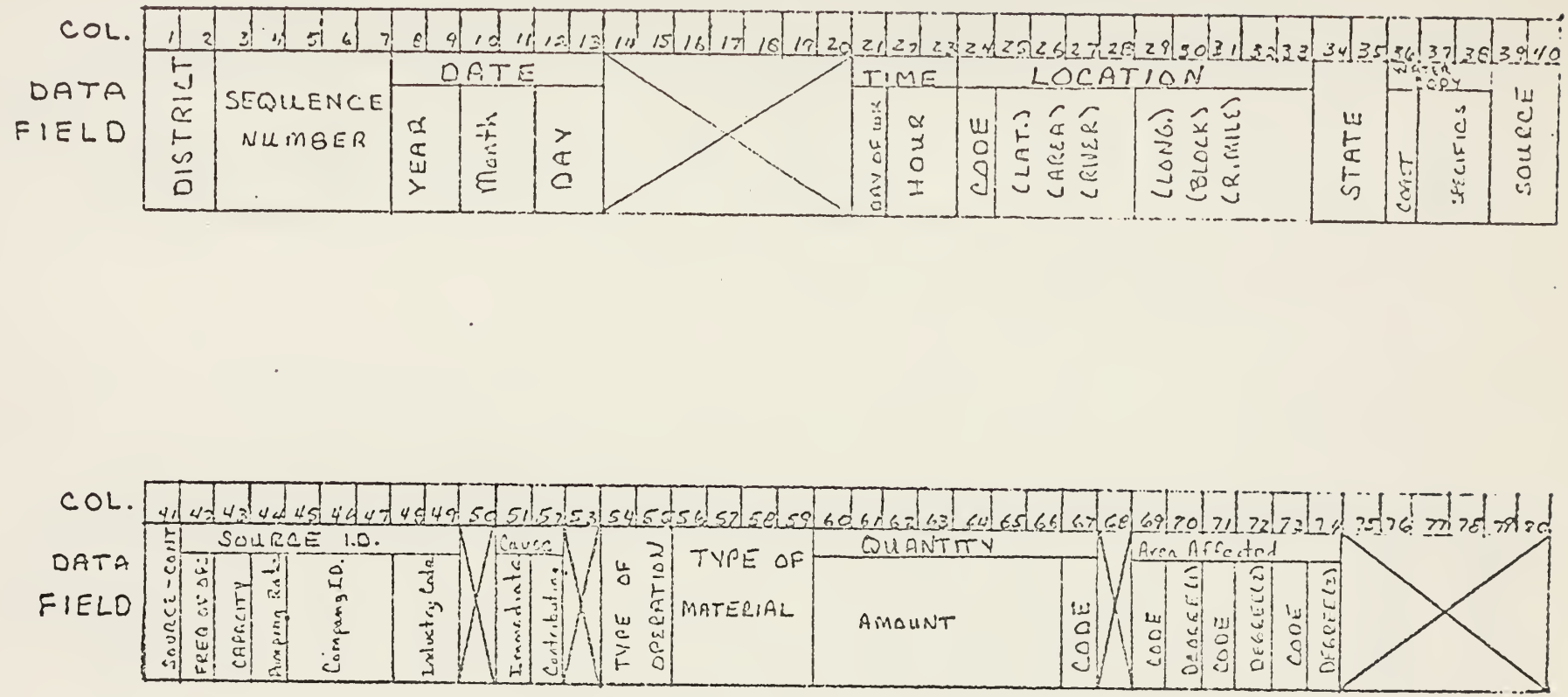

Figure 34

PIRS Record Characters 81 thru 160

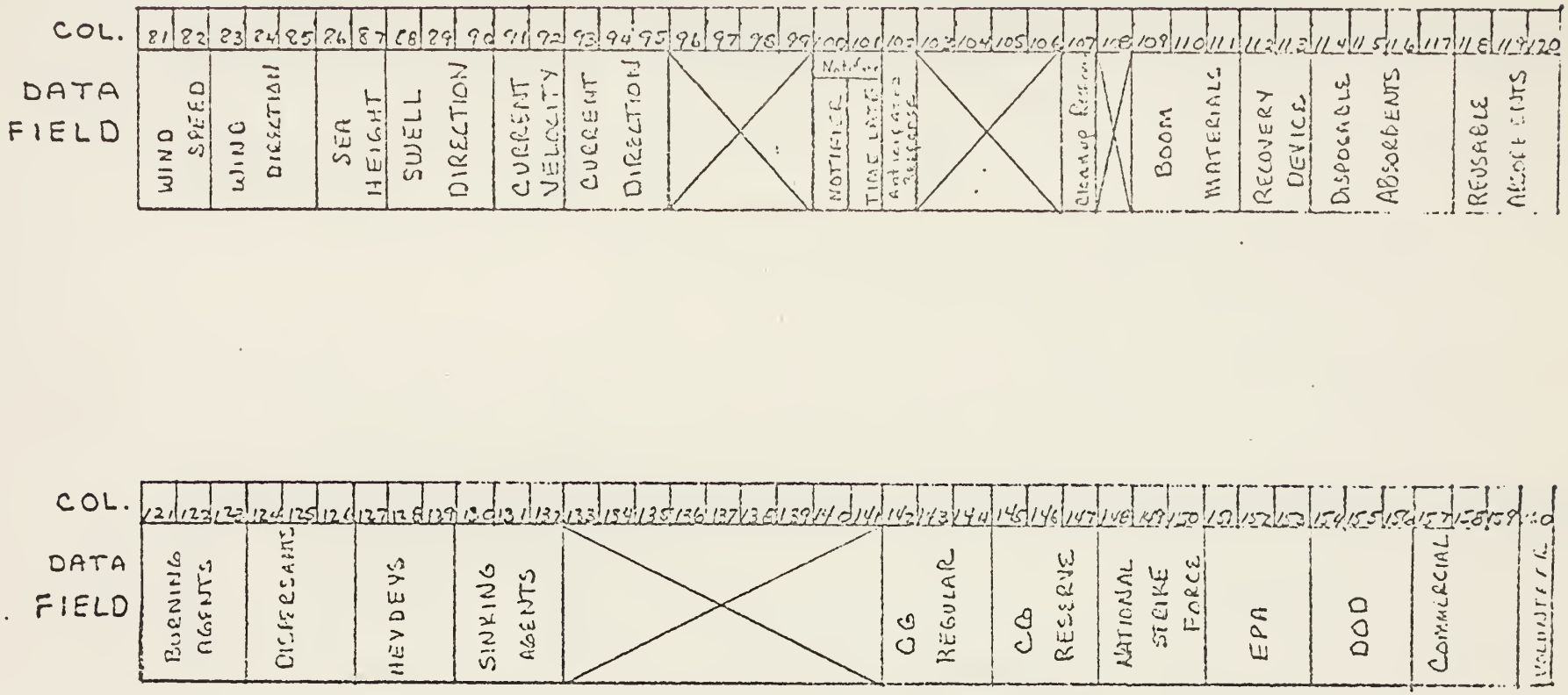

Figure 35

PIRS Record Characters 161 thru 240

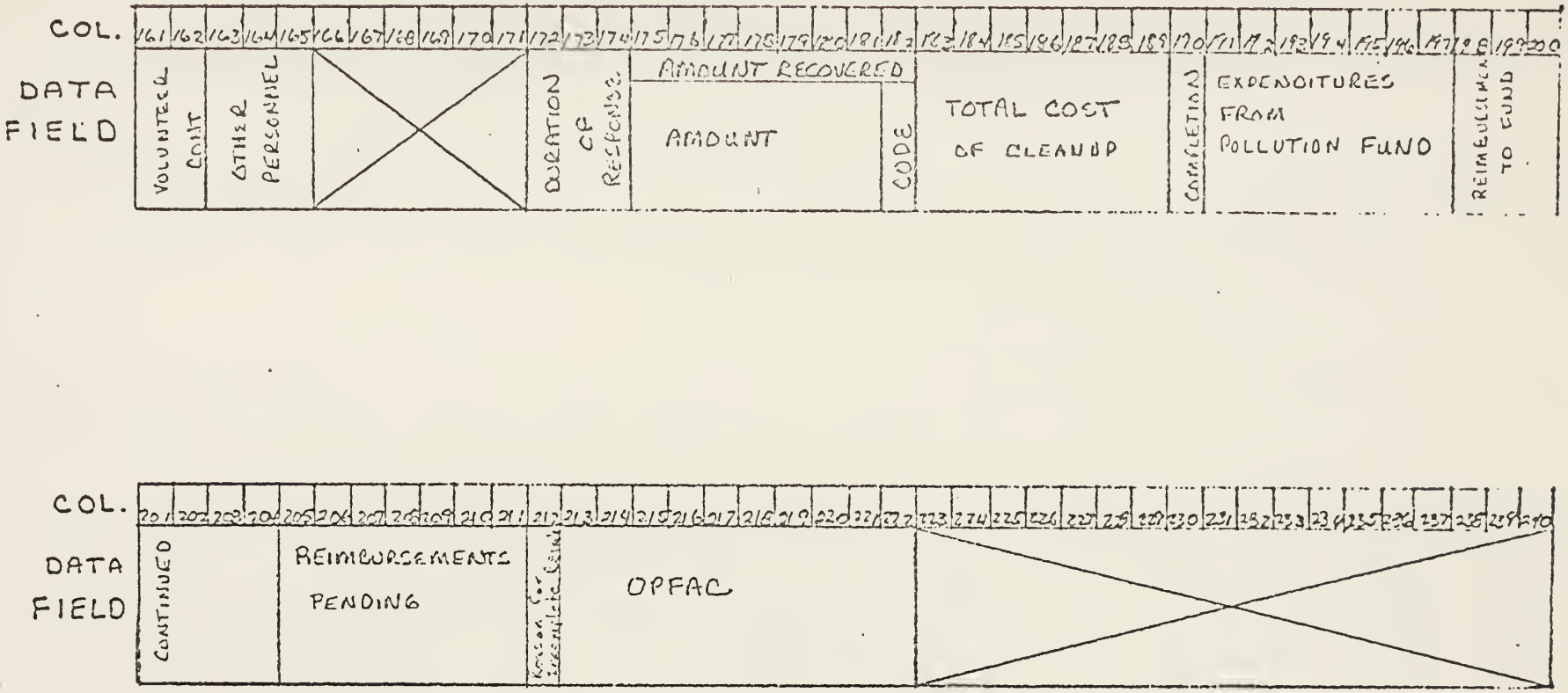

Figure 36

PIRS Record Characters 241 thru 320

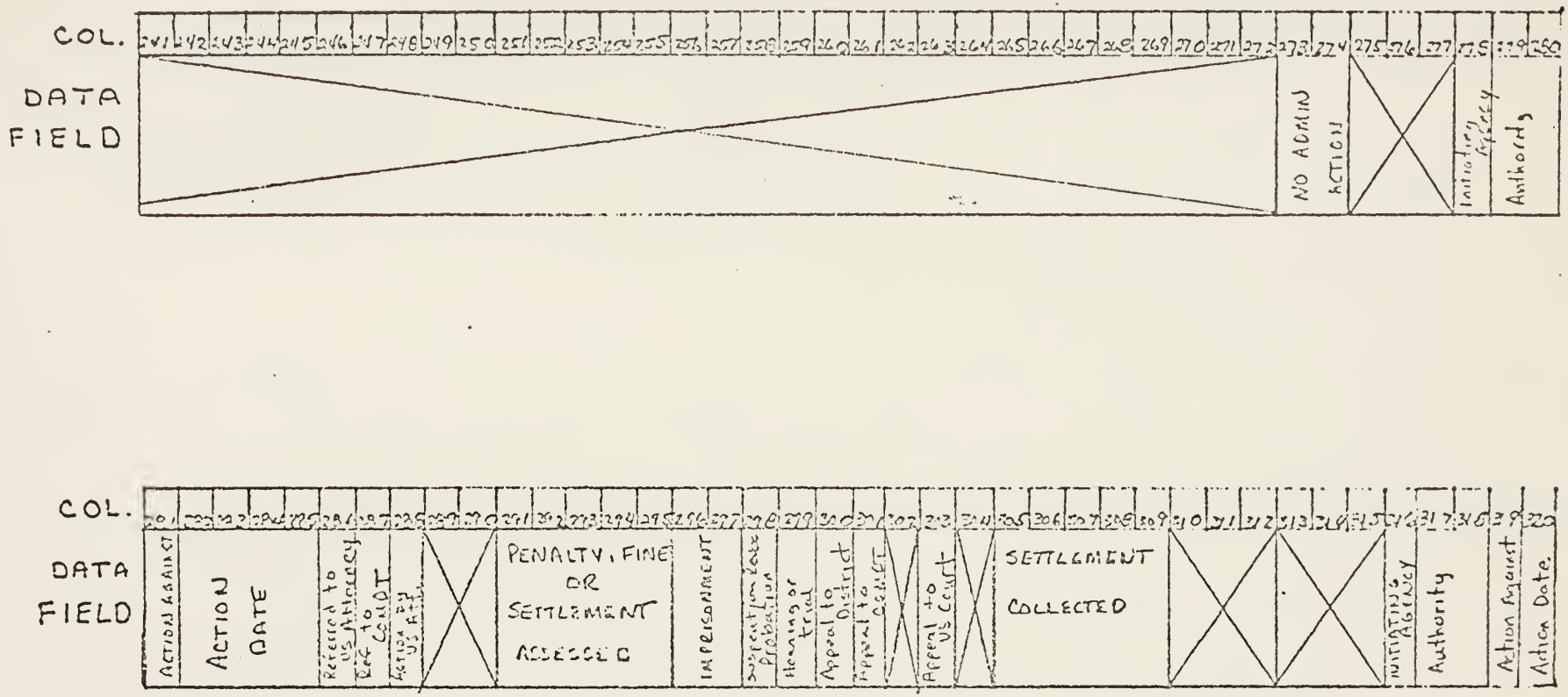

Figure 37

PIRS Record Characters 321 thru 400

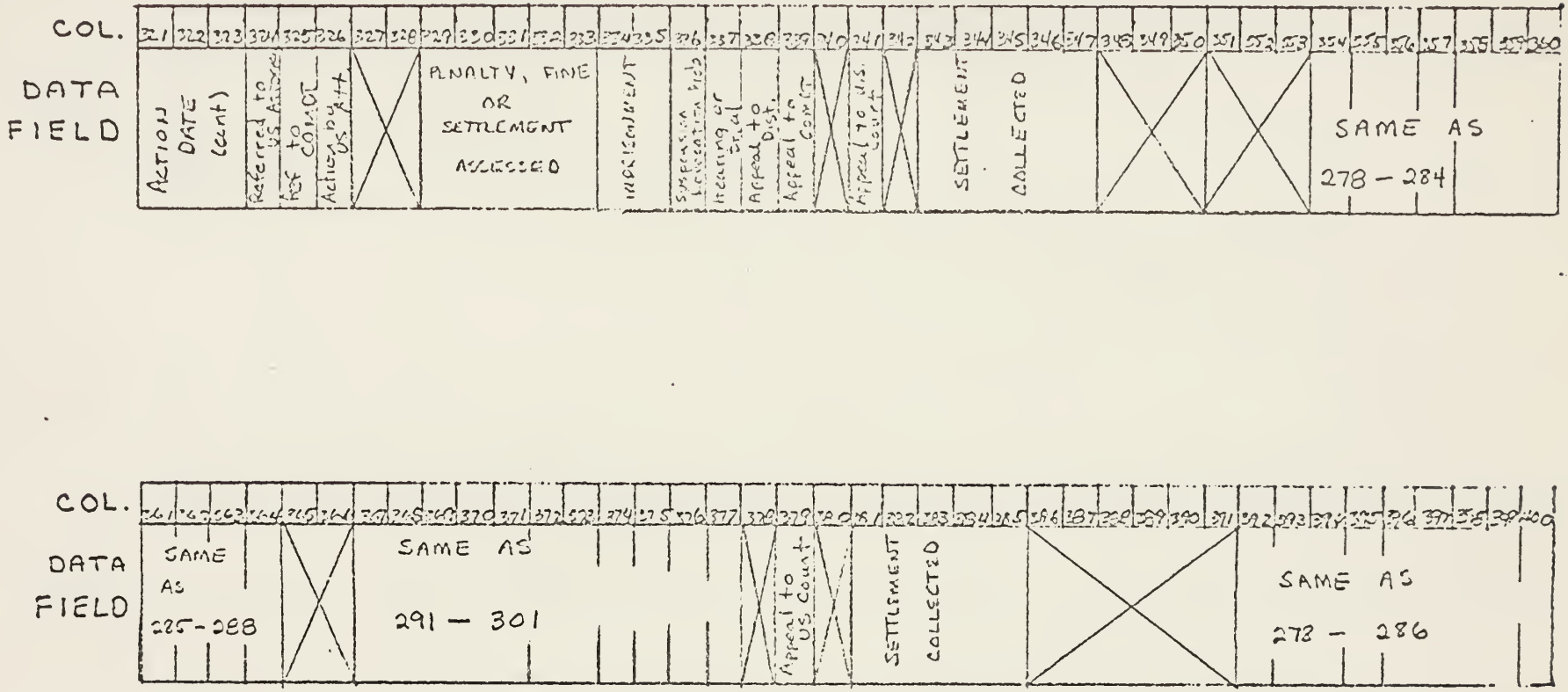

Figure 38

PIRS Record Characters 401 thru 421

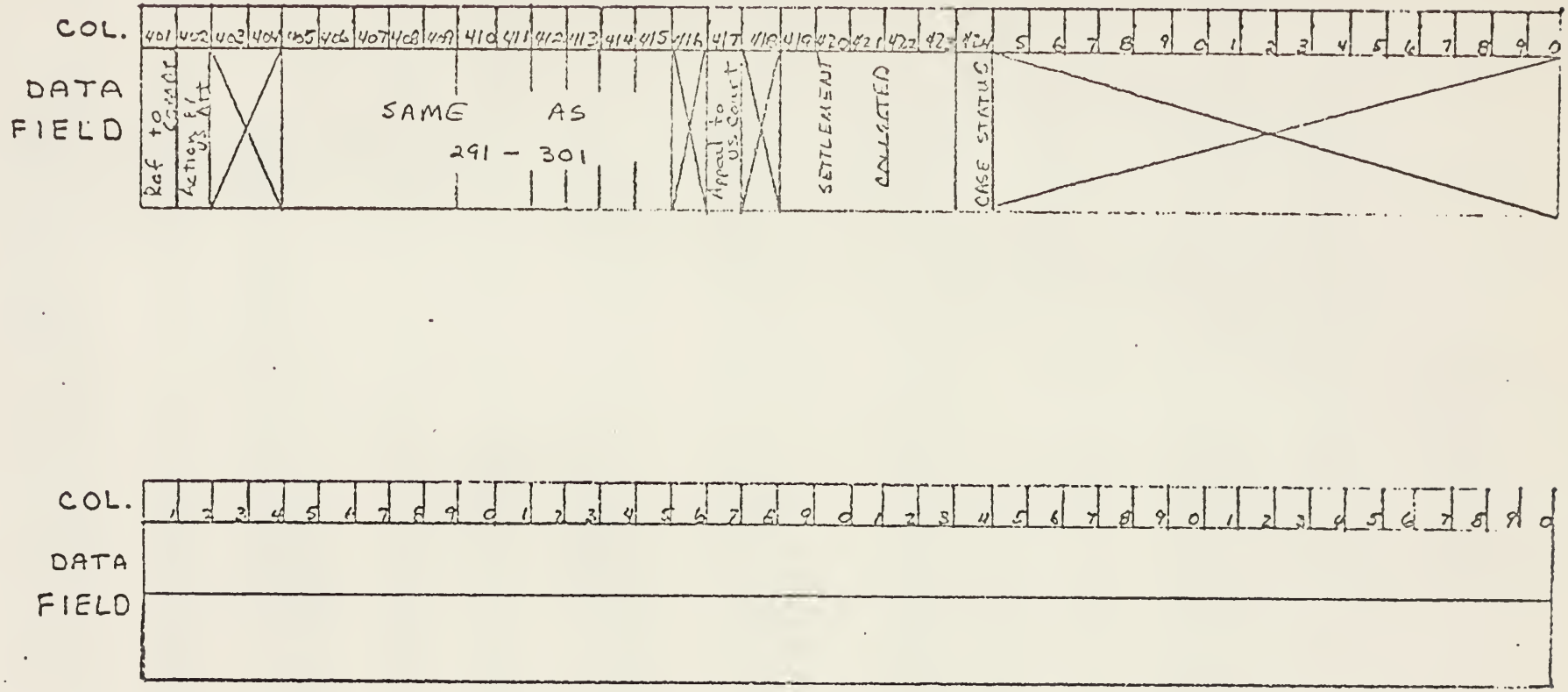

Figure 39

BIBLIOGRAPHY

1. Awerbuch, S., Baisuck, A., and Wallace, W.A., Measures of Program Effectiveness, Troy, New York, July 1973.

2. Awerbuch, S., Smith, H. Jr., and Wallace, W.A., "Regression Analysis as an Aid in Managing a Marine Environmental Protection Program," Journal of Environmental Systems, Vol. 4(2), Summer 1974.

3. Commander, Coast Guard District Twelve, Twelfth Coast Guard District OPLAN, San Francisco, 1975.

4. Leotta, J., Wallace, W.A., "The United States Coast Guard Pollution Incident Reporting System: Its Use in Program Management," 1975 Conference on Prevention and Control of Oil Pollution Proceedings, Library of Congress Catalog No. 75-4161.

5. Naval Postgraduate School, W. R. Church Computer Center Technical Note No. 0200-19, Directions for Using SPSS (Statistical Package for the Social Sciences), by G. P. Learmonth, March 1974.

6. Naval Postgraduate School, W.R. Church Computer Center Technnical Note No. 0211-03, Plotting Package for NPS IBM 360/67, by Patricia Johnson, January 1974.

7. Nie, N.H., Bent, D.H., and Hull, C.H., Statistical Package for The Social Sciences, McGraw-Hill, 1975.

8. United States Coast Guard, Air Operations Manual (CG-333), Washington, D.C., 1973.

9. United States Coast Guard, An Analysis of the Potential Application of Space Telecommunications Systems to U.S. Coast Guard Mission, Washington, D.C., 1973.

10. United States Coast Guard, Aviation Plan Study Report (CG-380-2), April 1973.

11. United States Coast Guard, "Enforcement of the Federal Water Pollution Control Act (FWPCA), Section 311 (33 USC 1321)", COMDINST 5922.11B, 10 October 1974.

12. United States Coast Guard, "Instructions for CG-4957 Port Safety/ Marine Environmental Protection Activities Report, "COMD-INST 5010.5, 14 September 1973.

13. United States Coast Guard, Organization Manual CG-450, Washington, D.C., 1974.

14. United States Coast Guard, Pollution Incident Reporting System Coding Instruction Manual CG-450, Washington, D.C., October 1973.

15. U. S. Code of Federal Regulations, 40-CFR-109 to 40-CFR-113 Environmental Protection Agency Regulations pertaining to Oil Pollution, 1974.

16. U. S. Code of Federal Regulations, 40-CFR-1510 Part II, "National Oil and Hazardous Substances Pollution Contingency Plan," February 10, 1975.

17. U. S. Code of Federal Regulations, 33-CFR-Subchapter O, U. S. Coast Guard Regulations Concerning Pollution, 1974.

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